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THE WITCHES' PHARMACOPŒIA.*

By Robert Fletcher, M. D.

The subject of this evening's paper is extraordinarily copious, and long-descended in its history. A belief in witchcraft characterized the earliest periods of which we have any record; it prevails among all savages or semi-civilized peoples at the present time, and is by no means extinct in otherwise intelligent communities. The cowardly fear and the resulting cruelties which have sprung from this strange superstition are too well known to need comment. In Merry England and in religious New England, men and women, old and young, the ministers of the Gospel, the clown and the philosopher, have perished at the stake or on the gallows, victims to this hideous delusion. A striking feature in the history of witchcraft is the fact that by far the greater number of its votaries were women, mostly old women. It is hard to find any explanation of this condition. King James I., in his Demonologia, ungallantly accounts for it by saying: "For as that sex is frailer than man is, so is it easier to be entrapped in these grosse snares of the Divell, as was over well proved to be true by the serpent's deceiving Eve in the beginning, which makes him the homlier with that sexe sensine."

The personal appearance of the typical witch was not attractive. Harsnet, in a work published in 1603, says a witch is "an old weather-beaten crone, having her chin and knees meeting for age, walking like a bow, leaning on a staff, hollow-eyed, untoothed, furrowed, having her limbs trembling with palsy, going mumbling in the streets; one that hath forgotten her paternoster, yet hath a shrewd tongue to call a drab a drab." (Declaration of Popish Imposture, 136.)

If she ventured out in the daylight she was pursued with obloquy. In Gay's fable of The Old Woman and her Cats, the poor creature exclaims:

> Crowds of boys
> Worry me with eternal noise;
> Straws laid across my path retard;
> The horse-shoe's nailed (the threshold's guard),
> The stunted broom the wenches hide,
> For fear that I should up and ride.
> They stick with pins my bleeding seat,
> And bid me show my secret teat.

Your genuine witch was believed to be incapable of shedding tears, and if through torture she could be made to weep, her power had departed and she became a helpless victim to justice. King James says: "They cannot even shed tears, though women in general are like the crocodile, ready to weep upon every light occasion."

Old age was not always a necessary adjunct to witchcraft. Some of the famous witches of classical times, such as Canidia, Erichthoë, and Circe, were beautiful women. The first was a famous hetaira and was once the mistress of Horace.

Accounts are given in history and legend of wizards who practised their diabolical art, but they seem to have labored for more important purposes than their female rivals. In old

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chronicles, in popular story, and above all in the drama, it is the witch who figures as the minister of evil, and it is with her and her marvelous storehouse of materials we have to do to-night.

It is a mistake to suppose that these materials consisted only of offensive or grotesque substances—of "eye of newt and toe of frog." If the time permitted it would not be difficult to show that certain legendary qualities attached to them have come down from classic and pre-classic days. This will to some extent appear as we progress in the enquiry, for the literature of witchcraft is very ancient, and it will be found that the same ingredients have been made use of through many ages to produce the like results. Astrology lent its aid, and plants which were under certain planetary influence, especially those belonging to the moon, acquired more potency in consequence. Old Culpepper, in his British Herbal, gives a list of over 500 plants with the planets which govern them. The doctrine of signatures too had its influence in the selection of ingredients for malevolent as well as for healing purposes, and if liver-wort or eye-bright were powerful for good, the lurid flowers and leaves of aconite, hemlock, henbane, and belladonna were manifestly suited for diabolic charms.

The term pharmacopœia made use of in the title of this paper, must be understood in its most comprehensive sense. It comprises substances from the vegetable and animal kingdoms, and the products of the atmosphere must be included.

In addition to its materia medica, witchcraft has its especial pharmacology. Not only must the materials be procured with certain magical forms and precautions, many of which are of Druidical origin, but the commixture must be made under spell and incantation. There are two divisions of the phar macopœia of witches, of distinctly opposite qualities—one, and the most numerous, comprising noxious ingredients, and the other consisting of the ordinary healing remedies of popular medicine. The woman who made use of the latter was known as a "white witch." She removed warts, cured fits, counteracted the spells laid upon cattle, and was looked upon as a generally beneficent sort of neighbor. The grey witch was one who, as occasion required, practised either the kindly or the malevolent arts, and the black witch was one who dealt in the latter exclusively. A mere list of the materials employed by the malevolent witch would be wearisome, and it will be more interesting and convenient to select from the rich stores of the drama and of poetry some passages which refer to witches and their baleful arts. Some comments elucidatory of the qualities and the folklore history of the ingredients employed, will, I trust, be not uninteresting.

The play most familiar to us all in which witches play a tragic part is, of course, Macbeth. Thomas Middleton, a contemporary of Shakespeare, was the author of a drama called The Witch which is wonderfully rich in this particular lore. A comedy by Thomas Heywood, entitled The Late Lancashire Witches, was published in 1634. Another comedy entitled The Lancashire Witches, and Teague O'Divelly the Irish Priest, written by Thomas Shadwell, was first performed at the Duke's Theatre in 1682. The two latter plays were reprinted in 1853 by Mr. James Orchard-Halliwell, the celebrated Shakespearean scholar, only 80 copies being printed. This work is now extremely scarce. From these plays and from collateral writings my illustrations will be drawn.

It is proper to say that in neither of these dramas has the author devised the proceedings he describes from his own imagination, so far as the materials and methods employed are concerned. These have been borrowed largely, and in some instances literally, from Reginald Scot's Discoverie of Witchcraft, published in 1584. He, in his turn, had delved with wonderful diligence in fields of all kinds from classic days to his own, and this confirms what I have already stated as to the great antiquity of the folklore of witchcraft.

The famous incantation scene when the witches are expecting the approach of Macbeth, and have filled their cauldron with the most powerful ingredients of their art, is curious as exhibiting almost exclusively substances of animal origin. The only exceptions are "root of hemlock digg'd i' the dark," and "slips of yew silver'd in the moon's eclipse." Familiar as it is, it must be repeated in full for the sake of some comments upon the composition of the "hell-broth."

First Witch. Round about the caldron go;
In the poison'd entrails throw,—
Toad, that under the cold stone
Days and nights hast thirty-one
Swelter'd venom sleeping got,
Boil thou first i' the charmed pot.

All. Double, double toil and trouble;
Fire burn, and, caldron, bubble.

Second Witch. Fillet of a fenny snake,
In the caldron boil and bake;
Eye of newt, and toe of frog,
Wool of bat, and tongue of dog,
Adder's fork, and blind-worm's sting,
Lizard's leg, and howlet's wing,—
For a charm of powerful trouble,
Like a hell-broth boil and bubble.

All. Double, double toil and trouble;
Fire burn, and, caldron, bubble.

Third Witch. Scale of dragon; tooth of wolf;
Witches' mummy; maw and gulf
Of the ravin'd salt-sea shark;
Root of hemlock digg'd i' the dark;
Liver of blaspheming Jew;
Gall of goat; and slips of yew
Silver'd in the moon's eclipse;
Nose of Turk, and Tartar's lips;
Finger of birth-strangled babe
Ditch-deliver'd by a drab—
Make the gruel thick and slab;
Add thereto a tiger's chaudron,
For the ingredients of our caldron.

All. Double, double toil and trouble;
Fire burn, and, caldron, bubble.

Sec. Witch. Cool it with a baboon's blood,
Then the charm is firm and good.

The commentators have expressed some conjectures as to what the "poisoned entrails" were, but there is, I think, no doubt that the term applied to the entire ingredients of the cauldron. The toad figures constantly in necromantic charms, and its venom, if it have any, is supposed to reside in the glands of the skin. The blind-worm is the slow-worm, which is spoken of in Timon as the "eyeless venom'd worm." As a matter of fact it is a harmless reptile. Mummy was formerly

one of the articles of the pharmacopœias, and its virtue was doubtless due to the aromatics with which it was endued. Sir Thomas Browne, in his Urn-burial, says of it: "The Egyptian mummies which Cambyses or time hath spared, avarice now consumeth. Mummie is become merchandise. Mizraim cures wounds, and Pharaoh is sold for balsams." The "gulf of the ravin'd salt-sea shark" is the stomach of that voracious fish. "Nose of Turk and Tartar's lips" seem to have no obvious qualifications, but it would be hard to find two lines of as concentrated expression as those which follow—

> Finger of birth-strangled babe
> Ditch-delivered by a drab.

The "tiger's chaudron" means the entrails of the animal. The tiger is of great importance in Chinese medicine; for an attack of hydrophobia the skull, teeth and toes of the animal are ground up and given in wine.

This wonderful collection of "poisoned entrails" was to be cooled with a baboon's blood. The baboon, or *babian* of the Dutch, was a large and dangerous ape, described by travelers of those times as found in great flocks near the Cape of Good Hope. Monstrous stories were told of it by contemporary writers.

When in reply to Macbeth's demand for further prognostications of his fate, more charms became needful, the first witch says:

> Pour in sow's blood, that hath eaten
> Her nine farrow; grease that's sweaten
> From the murderer's gibbet throw
> Into the flame.

In illustration of the first of these ingredients, Stevens quotes from Holinshed's History of Scotland, 1577, a law of Kenneth II. which provided that, "if a sowe eate her pigges let her be stoned to death and buried."

The fat or grease that drops from the body of the murderer hung in chains was one of the ingredients in the preparation of the "hand of glory," and it was also believed that where it fell the baleful mandrake sprang. Human fat was long believed to be a remedy for rheumatism and sprains. A German druggist once told me that it is still asked for, but that harmless goose-grease stiffened with spermaceti is the succedaneum, and when served from an antique jar with a mysterious inscription upon it, it gives great satisfaction.

Another and very important use of human fat was to anoint the body of a witch and thus enable her to soar through the air. This will be spoken of in more detail further on. In Middleton's play of The Witch, Hecate says to one of her followers:

> There, take this unbaptised brat;
> *Giving the dead body of a child.*
> Boil it well; preserve the fat;
> You know 'tis precious to transfer
> Our 'nointed flesh into the air,
> In moonlight nights.

This play of Middleton's was discovered in manuscript in the last century. It contains incantation scenes very similar to those in Macbeth, and it has been a matter of debate with the commentators whether Shakespeare copied his witch scenes from Middleton, or Middleton copied from Shakespeare. There is no question of the superiority of the latter in the strength and sublimity of the passages, but it may become necessary for the followers of Mr. Ignatius Donnelly to insist that Lord Bacon also wrote Middleton's plays.

In The Witch, Hecate recounts the materials of her charms, which belong to the vegetable materia medica. Stadlin, her acolyte, says:

> Where be the magical herbs?
> *Hecate.* They're down his throat;
> His mouth cramm'd full, his ears and nostrils stuff'd;
> I thrust in eleoselinum lately,
> Aconitum, frondes populeas, and soot—
> You may see that, he looks so black i' the mouth—
> Then sium, acorum vulgare too,
> Pentaphyllon, the blood of a flitter-mouse,
> Solanum somnificum et oleum.

These magical ingredients were crammed into the mouth and nostrils of the unbaptised babe before boiling him for his fat. The entire formula is taken almost literally from Reginald Scot's Discoverie of Witchcraft, and he obtained it from one of the curious works of John Baptista Porta, the Neapolitan, who wrote about everything that savored of superstition.

In the foregoing passage eleoselinum is the Apium petroselinum, or parsley. Sium is the winter-parsnip; acorum is calamus, which in the doctrine of signatures belongs to the stomach. Pentaphyllon is the Greek name for the cinquefoil, or Potentilla reptans, its five leaves representing the five senses. The flitter-mouse, or flicker-mouse, is the bat. The populeas frondes are the leaf-buds of the poplar, till lately used as an ointment. The poplar was also a funeral tree. In another scene of the same play Hecate asks of her son Firestone:

> Dear and sweet boy! what herbs hast thou?
> *Firestone.* I have some marmartin and mandragon.
> *Hecate.* Marmaritin and mandragora, thou wouldst say.
> *Firestone.* Here's panax too, I thank thee—my pan aches I'm sure,
> With kneeling down to cut 'em.
> *Hecate.* And selago.
> Hedge-hyssop too; how near he goes my cuttings!
> Are they all cropt by moonlight?
> *Firestone.* Every blade of 'em,
> Or I'm a moon-calf, mother.
> *Hecate.* Hie thee home with 'em;
> Look well to the house to-night; I'm for aloft.

Selago was a plant of much renown. It was probably the Club-moss, or Lycopodium selago, and was held in great repute by the Druids, who termed it Golden herb, or Cloth of Gold. It had to be gathered by a naked maiden on a moonlight night under a cloudless sky. When she touched the plant with her foot it was taken up with many precautions, and it conferred on the possessor the power of understanding the language of birds and beasts. There is a curious old print representing the damsel touching the plant with her foot while two Druid priestesses watch the proceeding. They are standing under an oak tree, and one of them holds a branch of mistletoe in her hand. The print has been reproduced by Mr. Folkard in his Plant-Lore. The hedge-hyssop is the Gratiola.

There is much folklore connected with parsley. The Greeks bestowed a crown of dried parsley on the victor at the Isthmian games. They strewed it also on the bodies of the dead. A despairing lover cries:

"Garlands that o'er thy door I hung,
Hang withered now and crumbling fast;
Whilst parsley on thy fair form flung,
Now tells my heart that all is past."

Its ominous association with death no doubt accounted for its presence in necromantic compounds. It was also an emblem of generation, and the belief survives in the nurse's story to the children that the newly arrived infant was dug out of the parsley-bed. Of the mandragon or mandrake much will have to be said presently.

To return to Middleton's play. In the fifth act a Duchess, "on fell thoughts intent," enters the abode of Hecate, and finds the queen of witches before a caldron. This dialogue ensues:

Hec. What death is't you desire for Almachildes?
Duch. A sudden and a subtle.
Hec. Then I've fitted you.
Here lie the gifts of both, sudden and subtle;
His picture made in wax, and gently molten
By a blue fire kindled with dead men's eyes,
Will waste him by degrees.
Duc. In what time, prithee?
Hec. Perhaps in a moon's progress.
Duc. What, a month?
Out upon pictures, if they be so tedious!
Give me things with some life.
Hec. Then seek no farther.
Duc. This must be done with speed, dispatch'd this night,
If it may possible.
Hec. I have it for you:
Here's that will do't; stay but perfection's time,
And that not five hours hence.

After further colloquy the Duchess leaves and Hecate proceeds to concoct her fatal mixture.

Hec. Give me some lizard's brain; quickly, Firestone.
Where's grannam Stadlin, and all the rest o' th' sisters?
Fire. All at hand, forsooth.
Enter Stadlin, Hoppo, and the witches.
Hec. Give me marmaritin, some bear-breech; when?
Fire. Here's bear-breech and lizard's brain, forsooth.
Hec. Into the vessel;
And fetch three ounces of the red-hair'd girl
I killed last midnight.
Fire. Whereabouts, sweet mother?
Hec. Hip, hip or flank. Where's the acopus?
Fire. You shall have acopus, forsooth.
Hec. Stir, stir about, whilst I begin the charm.
Black spirits and white, red spirits and gray,
Mingle, mingle, mingle, you that mingle may!
Round, around, around about, about!
All ill come running in, all good keep out!
First Witch. Here's the blood of a bat.
Hec. Put in that, O, put in that!
Sec. Witch. Here's libbard's-bane.
Hec. Put in again!
First Witch. The juice of toad, the oil of adder.
Sec. Witch. Those will make the younker madder.
Hec. Put in—there's all—and rid the stench.
Fire. Nay, here's three ounces of the red-haired wench.
Chorus. Round, around, etc.

Of the ingredients made use of for this potion intended to be fatal to the Duchess's husband or lover, the bear-breech deserves some notice. It is the Acanthus mollis, much employed for decorative purposes by the Greeks and Romans. Its leaves form the principal adornment of the capital of the Corinthian pillar. The story of its origin is too well known to need repeating. The oil of adder is probably not a product of the snake, but is the "greene oyle" obtained by boiling the Adder's tongue, or Ophioglossum vulgatum, in olive oil. The herb was in great favor with witches. The libbard's-bane or leopard's bane, often called wolf's-bane, is the Aconite. In Ben Jonson's Masque of Queens is this verse:

I ha' been plucking, plants among,
Hemlock, henbane, adder's-tongue,
Night-shade, moonwort, libbard's-bane.

It is suggested by the commentators that the poison which the Apothecary sold to Romeo was Aconite. The latter demanded a poison so swift with action—

That the life-weary taker may fall dead,
And that the trunk may be discharged of breath
As violently as hasty powder fired
Doth hurry from the fatal cannon's mouth.

This is possibly confirmed by a passage in the second part of Henry IV.:

Though it do work as strong
As Aconitum or rash gunpowder.

It is a classic legend that Aconite sprung originally from the foam dropped from the mouth of Cerberus, the triple-headed dog of hell. The hood-shaped flower from which its name of monks-hood was derived, was in Scandinavian folklore known as "Thor's hat." Ben Jonson in his play of Sejanus (Act III.) describes a homœopathic use of Aconite:

I have heard that Aconite
Being timely taken hath a healing might
Against the scorpion's stroke; the proofe we'll give
That while two poisons wrastle, we may live.

Henbane, the Hyoscyamus, was another plant of ill omen. Plutarch tells us that it was woven into a chaplet for the dead. Juno's horses were fed upon it, according to Homer, and it still holds a place in the veterinary pharmacopœia as a remedy for certain equine disorders. It is supposed to be the "insane root" which Banquo speaks of:

Have we eaten of the insane root
That takes the reason prisoner?

Old Bartholomæus says of it: "Henbane is called insana, mad, for the use thereof is perilous, for if it be eate or dronke, it breedeth madness, or slow lykenesse of death."

The yew-tree, from its sombre foliage and its constant presence in churchyards, had an evil repute. Shakespeare calls it "the double fatal yew," from the poisonous qualities of its leaves and from its wood being employed to furnish bows, the instruments of death. It was famous for the latter purpose. Browne writes of it as—

The warlike yeugh, by which more than the lance
The strong-armed English spirits conquered France.

It was much used by the witches in their charms. Hecate announces to the aërial spirit:

> With new fallen dew
> From churchyard yew
> I will but 'noint,
> And then I'll mount.

It has been thought that the "juice of cursed hebenon," which caused the death of Hamlet's father, was the juice of yew leaves. In Marlowe's Jew of Malta it is called "juice of hebon." Eben, hiben, were Norse names of the yew.

Hemlock, the Conium maculatum, is supposed to be the fatal poison administered to Socrates, Phocion and other Greeks condemned to death by the Areopagitica. It is a constant ingredient of the witches' charms.

The Deadly Nightshade, the Atropia belladonna, is a powerful poison also much used by witches. Those who partook of it were seized with madness, during which they prophesied and saw visions. Possibly the dilatation of the pupils, the well known effect of atropine, accounted for this latter belief. The Solanum dulcamara, the common nightshade, had poisonous berries, but the root and stems were employed in medicine, though their use is, I suppose, now obsolete.

Among the ingredients employed by Hecate there are two which the commentators have given up in despair of their identification, namely, acopus and marmaritin. Nevertheless, both of them are mentioned by Pliny in his Natural History. Acopus, or acopos, he describes as "a stone like nitre in appearance, porous and starred with drops of gold. Gently boiled with oil and applied as an unguent it relieves lassitude, if we choose to believe it," he discreetly adds. Marmaritis he says is the plant Aglaophotis, which owes its name to the admiration in which its beauteous tints are held by man. "It is found growing among the marble quarries of Arabia on the side of Persia, a circumstance which has given it the additional name of Marmaritis" (from *marmor*, marble). "By means of this plant," he continues, quoting from Democritus, "the Magi can summon the deities into their presence when they please." It is interesting to observe a bit of Magian lore coming from ancient Persia preserved in the charm of a witch in the 17th century. The plant has not been identified, though it has been with some reason supposed to be the Peony. This handsome flowering plant was held in great esteem by the ancient Greeks. Its name Pæonia was derived from Pæan, the first physician who attended upon the divinities upon Olympus. According to Homer he healed the wounds of Ares and Hades. The name Pæon was also applied to Apollo, and a pæan was a song which celebrated his healing power. Pæonia, or the healing goddess, was also one of the names of Minerva.

The unhappy old women who were suspected of being witches were subjected to many well known ordeals to make them confess their diabolic powers. Even in very recent times there are accounts of ignorant rustics tying the thumbs and toes of a supposed witch together and throwing her into a pond, where if she floated she was a witch, and if she sank, as was most likely, she usually died from the ill usage. It is gratifying to know that Matthew Hopkins, the notorious witch-finder, met his death in this manner at the hands of some country fellows who believed him to be a wizard. Hudibras refers to the miscreant's fate in these lines:

> "Who after proved himself a witch,
> And made a rod for his own breech."

Hopkins' method was to probe all parts of the woman's body with pins or needles until he found the "witch spot," which was insensible to pain. There is still to be seen in the courthouse of Salem, Massachusetts, a bottle of pins which had been used in this manner during the witch-hunting which led to the execution of twenty-two persons on Gallows-Hill in that city in 1692. In Shadwell's play of The Lancashire Witches, Sir Jeffery, a justice of the peace, says:

"Now, you Shocklehead, and you Clod, lay hold o' th' witch quickly. Now you shall see my skill; wee'l search her; I warrant she has biggs or teats a handful long about her parts that shall be namelese; then wee'l have her watched eight and forty hours, and prickt with needles, to keep her from sleeping, and make her confess; gad, shee'l confess anything in the world then; and if not, after all, wee'l tye her thumbs and great toes together and fling her into your great pond."

The "biggs or teats"—bigg is an old English name for a cow's teat—refer to a curious belief. Every witch was supposed to have in some unseen part of her body a teat with which she nourished her own particular imp or familiar. There is no reference to it in ancient writers; it seems to have been a happy discovery of the English witch-finders.

In a scene of the same play the witches are relating to their master the Devil, who is in the form of a black goat, their several achievements. Mother Demdike says:

> To a mother's bed I softly crept,
> And while the unchristen'd brat yet slept,
> I suckt the breath and a blood of that,
> And stole another's flesh and fat,
> Which I will boyle before it stink.

The use made of the fat of an unbaptised child has been already mentioned, but there is something to be said as to the sucking its breath. A cat, especially a black cat, was the familiar companion of the witch, and she was supposed to sometimes assume its form and suck a sleeping child's breath till she destroyed it. The common belief that a cat may perform this injurious act not improbably had its origin in the superstition that the creature was a witch in disguise.

Among the functions of witches, the preparation of philters, or love cups, which were to procure the affections of youth or maiden, played an important part. It must be said that the ingredients of these charms were obscenely nasty, and most of them may well be omitted from notice. In the same scene of the play just quoted, Mother Spencer says:

> To make up love-cups, I have sought
> A wolf's tayle-hair and yard; I've got
> The green frog's bones, whose flesh was ta'en
> From thence by ants; then a cat's brain;
> The bunch of flesh from a black fole's head,
> Just as his dam was brought to bed,
> Before she lickt it.

The bunch of flesh upon the newborn foal's head is the Hippomanes, concerning which some wondrous beliefs were held.

It was of black color, the size of a fig, and if it was removed artificially instead of being licked off by the mother-mare, she refused to allow the foal to suck. Virgil, Ovid, and other classical authors speak of it as a famous aphrodisiac and much employed in the preparation of love philters. Thus there is another instance of the antiquity of the witches' materials. Cuvier says that the hippomanes is a concretion sometimes found in the liquor amnii of the mare, and is eaten by her just as the placenta is eaten by many animals after parturition.

Further on, one of the persons of the play says: "Fennel is very good in your house against spirits and witches; and alicium, and the herb mullein, and longwort, and moly, too, is very good."

Fennel was given to the victors in the Isthmian games, and on account of its pleasant odor and graceful tendrils it is used even now as a decoration for the table. It was hung on doorways to keep away evil influence. Mullein, the Verbascum thapsus, from its woolly fibres was readily inflammable, and its stalks dipped in suet made a candle which was known as hig- or high-candle, and by corruption, hag-candle. The ancient Romans called the plant Candelaria, and used it as a torch at funerals. In Italy it is still called Light of the Lord.

Alicium has not been identified.

Longwort is the Pulmonaria or lungwort, sometimes known as the Jerusalem cowslip. From its spotted leaves it was, under the doctrine of signatures, held to be a remedy for diseased lungs.

Much has been written about the herb Moly, which is the last named in this passage. It was first mentioned by Homer as the remedy given by Hermes to Ulysses to enable the latter to withstand the enchantments of Circe. It has been thought to be a species of Allium or garlic. It is worth noting that most of the preservatives against evil influences were strong aromatics.

In the same scene Mother Demdike and her excellent sisters give us some further insight into their pharmacopœia:

Demd. Oyntment for flying here I have,
Of children's fat stoln from the grave,
The juice of smallage and nightshade,
Of poplar-leaves and aconite made;
With these
The aromatick reed I boyl,
With water-parsnip and cinquefoil,
With store of soot, and add to that
The reeking blood of many a bat.

Mother Dickinson. From the sea's slimy owse a weed
I fetched to open locks at need.
With coats tukt up, and with my hair
All flowing loosely in the air,
With naked feet I went among
The poisonous plants, there adders-tongue,
With aconite and martagon,
Henbane, hemlock, moon-wort too,
Wild fig-tree that o'er tombs do's grow,
The deadly nightshade, cyprus, yew,
And libbard's-bane, and venomous dew,
I gathered for my charms.

Mother Hargrave. And I
Dug up a mandrake, which did cry;
Three circles I made, and the wind was good,
And looking to the west I stood.

Most of these plants have already been commented upon. Smallage is our familiar celery, which has appropriately fallen from a witch's ingredient into a preposterous quack remedy of the present day. What kind of weed it was "from the sea's slimy owse" which would open locks, I cannot tell. It was a part of the ceremonial to go with naked feet and hair unbound when gathering magic herbs.

The Martagon is the Moonwort, the Botrychium lunaria. If placed in a key-hole it had the power of opening the lock. This fabulous quality is described by Pliny in his account of the plant. It is perhaps the same as the Springwort, famous in German legend for its use in opening treasure-chests. The legends connected with the fig-tree are very ancient and numerous. Under its boughs Adam concealed himself after tasting the forbidden fruit. Each blossom was inhabited by an evil spirit. In this particular instance it was a fig-tree that had grown over a tomb.

All of the herbs mentioned in the foregoing passage are described as magical herbs by Porta, Paracelsus and Agrippa.

A characteristic bit of malice on the part of the witches is described further on in the play of The Late Lancashire Witches, by Heywood and Brome, 1624. Joan has been preparing a dinner for some guests, when she breaks in upon them with this mournful story:

Joan. O husband, O guests, O sonne, O gentlemen, such a change in a kitchen was never heard of; all the meat is flown out o' the chimney-top, I thinke, and nothing instead of it but snakes, batts, frogs, beetles, hornets and bumble bees; all the sallets are turned to Jewes ears, mushromes, and puckfists; and all the custards into cowsheards.

The salads provided for this unlucky feast were all turned into fungi of various evil characters. The Jews' ears is the Auricula Judæ, a fungus resembling the human ear, which grows upon the elder, on which tree Judas was said to have hanged himself. The puckfist is the common puff-ball. Cowsheards, or cowshards, is cow-dung.

In a beautiful fragmentary play of Ben Jonson's, The Sad Shepherd, a similar scene is described. The hunting has been successful and the venison is laid before the fire, when a malignant witch, Maud, enters and utters this curse:

Maud. The spit stand still, no broches turn
Before the fire, but let it burn
Both sides and haunches, till the whole
Converted be into one coal.

Clarion. What devil's paternoster mumbles she?

Aiken. Stay, you will hear more of her witchery.

Maud. The swilland dropsy enter in
The lazy cuke and swell his skin;
And the old mort-mal on his shin
Now prick and itch withouten blin.

Clarion. Speak out, hag, we may hear your devil's matins.

Maud. The pain we call St. Anton's fire,
The gout, or what we can desire
To cramp a cuke in every limb,
Before they dine, yet seize on him.

The "swilland dropsy" is the watery dropsy. The "mort-mal" is a term used by Chaucer, and means an ulcer; so "the old mort-mal on his shin" is a chronic ulcer of the leg, which was to prick and itch withouten blin—that is, without

ceasing—an appropriate torment for the cook, whose function required him to stand almost continually. What disease was meant by St. Anthony's fire has been much debated. It is most probable that it was ergotism, the Kriebelkrankheit of the Germans, a dry gangrene of the extremities, the effect of the continued use of rye-flour containing ergot. "Saint Anton fire thee!" was a common form of malediction.

It is an ancient belief that witches had power over the moon and could cause its light to change or disappear under the influence of their spells. Prospero describes Caliban's mother, "the foul witch Sycorax," as one "so strong that could control the moon." Centuries before Shakespeare's time the same belief prevailed, for Aristophanes introduces it in his comedy of The Clouds. Strepsiades tells Socrates that he has a plan to do away with paying of interest, for, says he:

> If I were to buy a Thessalian witch, and draw down the moon by night, then shut her up in a round helmet-case like a mirror, and keep watching her—
>
> *Soc.* What good would that do you then?
>
> *Strep.* What? If the moon were not to rise any more anywhere, I should not pay the interest.
>
> *Soc.* Because why?
>
> *Strep.* Because the money is lent by the month.

The time of the full moon was especially favorable for gathering herbs for use in spells. In The Merchant of Venice, Jessica, sitting with the amorous Lorenzo in the brilliant light of the full moon, says:

> On such a night
> Medea gathered the enchanted herbs
> That did renew old Jason.

The belief in astrology, as prevalent in classic as in recent times, had much to do with the witches' materia medica. The signs of the zodiac, with their fantastic relations to the human body, are still regarded with belief in their importance. A story is told of a well-to-do farmer who was ordered a purgative but who would not swallow it because he had looked in the almanac and seen that the sign for the month was in *bowels*, and he thought the two together would be too much for him.

Of all plants possessing necromantic endowments, the mandrake is the most famous. In our present pharmacopœias the name is appropriated to the harmless Podophyllum, but the old herbals term it the Atropa mandragora, its first name being derived from Atropos, one of the dreaded Parcæ. There are numerous allusions to it in the classic writers, and a well known one in Genesis, chapter xxx. The lad Reuben brings home mandrakes to his mother Leah. The barren Rachel begged them of the latter, and even gave up her husband Jacob for the night to her more fruitful rival, trusting doubtless to the supposed power of the root to cure sterility. There were said to be two forms of the mandrake, the male plant, which had a pleasant perfume, and the female, of which the leaves were large and had a rank odor. Cruden in his Concordance suggests that Reuben would naturally bring home to his mother only the sweet smelling plants of the harvest field, and the only other reference to the mandrake in the Bible is in Canticles vii. 13, where it is said, "The mandrake gives a smell, and at our gates are all manner of pleasant fruits."

The account given of the mandragora by Pliny is interesting from a far-away hint at an anæsthetic. "It is given," he says, "before incisions or punctures are made in the body, in order to ensure insensibility to pain. Indeed, for this last purpose the odor of it is quite sufficient to induce sleep." It has been thought that the mandrake was identical with the Eryngium, a root which had a fancied resemblance to the genitals, and which Pliny says had been administered to Sappho and was the cause of her passionate love for Phaon.

Joannes Wierus, in his De presagiis dæmonum, Basel, 1563, states that Josephus describes a root called in the Hebrew, Baaras, which in the evening emits sparks of light. Like the mandrake, its extraction from the earth is attended with swift death to the person attempting it. To avoid this danger, a young dog which was kept without food for twenty-four hours was fastened to the root with a string, and upon meat being placed in advance of him he naturally rushed towards it, drawing out the root thereby. If the sun shone on the root the dog died suddenly, and was buried with secret ceremonies. A favorite habitat for the mandrake was the earth at the foot of a gibbet, the fat which dropped from the murderer's body encouraging its growth; when drawn from the ground it emitted shrieks like the cries of a human being, and death or madness fell upon the rash experimenter. It was partly a plant and partly an evil spirit, and it may be well supposed that with all these qualities it was a choice ingredient for the witches' potions.

There is preserved at Vienna, so Dr. Danberry relates, a manuscript copy of the work on Materia Medica of the Greek physician Dioscorides, who lived in the first or second century. It contains a curious drawing representing the goddess Discovery presenting to the author a mandrake freshly plucked from the earth. The root has an entirely human appearance, and the dog which had been employed to extract it is lying dead on the ground. The manuscript is of the fifth century.

The English romance-writer, William Harrison Ainsworth, who was deeply read in witch-lore, has embodied these beliefs regarding the mandrake in a spirited ballad, part of which may be quoted:

> At the foot of the gibbet the mandrake springs,
> Just where the creaking carcase swings;
> Some have thought it engendered
> From the fat that drops from the bones of the dead;
> Some have thought it a human thing,
> But this is a vain imagining.
> And whether the mandrake be create
> Flesh with the flower incorporate,
> I know not; yet, if from the earth 'tis rent,
> Shrieks and groans from the root are sent; . . .
> Whoso gathereth the mandrake shall surely die;
> Blood for blood is his destiny.
> Some who have plucked it have died with groans
> Like to the mandrake's expiring moans;
> Some have died raving, and some beside
> With penitent prayers—but *all* have died.
> Jesu! save us by night and by day
> From the terrible death of mandragora!

Certain portions of the human body played an important part in the charms prepared by witches, such as the hair, the nails, blood, saliva, etc. Most of these entered into the composition of philters or love potions. If a love-sick maid could administer, in a cake or bread, cuttings from the hair or nails of the desired youth mixed with similar portions from her own person, he was certain to become madly in love with her. Among many tribes of North American Indians it is a custom still prevailing to bury the parings of the nails and portions cut from their hair, lest they should be employed for hurtful purposes. Dalyell, in his "Darker Superstitions of Scotland," relates that a young woman was indicted by the judicatories of Leipzig in 1623 for administering an amatory charm of bread compounded with hair and nails to a man whom it sickened (p. 219). The most important use of the human body was in the preparation of the unguent with which the witch anointed her body to enable her to fly through the air on her forbidden errands. Allusion has been made to this in some of the passages already quoted. John Wier, whose work is a perfect treasury of witch-lore, says that the proper method was to boil an unbaptised child in a caldron. The thick part of the concoction was made into an unguent, and the thinner part was bottled. "Whoso drank of the latter became immediately a companion of the order, a great clerk and master." Jerome Cardan gives a formula in which the fat of a child is mixed with parsley, aconite, cinquefoil, belladonna and soot. Probably the earliest specific account given of the use of such an ointment is to be found in The Golden Ass of Apuleius, written in the second century. Lucius, the hero, by the connivance of the waiting-maid, watches his hostess, a famous witch, while performing her necromantic rites in the privacy of her chamber at midnight. She anoints her body with an unguent, whereupon feathers and wings spring out, and thus transformed into a bird she flies out of the window. Lucius, determined to try the experiment upon himself, persuades the maid to bring him the ointment. She unintentionally fetches a different jar, and poor Lucius, to his horror, finds himself transformed into an ass. His adventures after being thus transmogrified form the subject of this celebrated romance.

Toward the end of the 16th century there flourished in Scotland a notable wizard named Doctor Fian, who was a schoolmaster. He became enamored of a young lady of great beauty, whose brother was one of his pupils. Failing to ingratiate himself with the sister, he resorted to "conjuring, witchcraft and sorcerie." The rest of the story shall be told as it is related in Pitcairn's Criminal Trials of Scotland, I, 213. So, "calling the said scholler to him demanded if he did lie with his sister, who answered he did: By means whereof he thought to obtain his purpose; and therefore secretly promised, to teach him without stripes, so he would obtain for him three haires from his sisters privities, at such times as he should spie best occasion for it, which the youth promised faithfully to perform, and vowed speedily to put it in practise, taking a piece of conjured paper of his master to lay them in, when he had gotten them: and thereupon the boy practised nightly to obtain his masters purpose, especially when his sister was asleep. But God, who knoweth the secrets of all harts, and revealeth all wicked and ungodly practises would not suffer the intents of this divelish Doctor to come to that purpose which he supposed it woulde; and therefore to declare that hee was heavily offended with his wicked intent, did so work by the gentlewomans owne meanes, that in the end the same was discovered and brought to light: for shee being one night a sleepe, and her brother in bed with her, sodainly cried outt to her mother, declaring that her brother wolde not suffer her to sleepe: Whereupon her mother having a quicke capacitie, did vehemently suspect Doctor Fians intention, by reason she was a witch of herself; and therefore, presently arose, and was very inquisitive of the boy to understand his intent: and the better to know the same did beate him with sundrie stripes, whereby he discovered the truth unto her. The mother, therefore, being well practised in witchcraft, did thinke it most convenient to meete with the Doctor in his own arte: and thereupon took the paper from the boy, wherein hee should have put the same haires, and went to a yong heyfer which never had borne calfe, nor gone unto the bull, and with a paire of sheeres clipped off three haires from the udder of the cow, and wrapt them in the same paper, which shee again delivered to the boy: then willing him to give the same to his sayde master, which hee immediately did. The school maister, so soone as he had received them, thinking them indeed to be the maids haires, went straight and wrought his arte upon them. But the Doctor had no sooner done his intent to them, but presently the hayfer cow, whose haires they were indeede, came unto the door of the church wherein the school maister was, into the which the hayfer went, and made towards the school maister, leaping and dauncing upon him, and following him forth of the church, and to what place soever he went; to the great admiration of all the townes men of Saltpans, and many others who did beholde the same. The report whereof made all men imagine he did worke it by the Devill, without whome it coulde never have been sufficiently effected: and thereupon the name of the saide Doctor Fian (who was but a young man) began to growe common among the people of Scotland, that he was secretly nominated for a notable conjurer."

There were other charges brought against the wizard at his trial beside the foregoing one, and the result was that the luckless doctor was burned at the stake in Edinburgh in January, 1591.

A cognate subject of investigation to that which we have been pursuing is the preservation against the power of witchcraft. It would lead us too far afield for the present occasion, and a very brief notice must suffice. English county folklore abounds in spells which had a protecting power, and plants under especial planetary influences were largely employed. They were purposely cultivated in domestic gardens, and many of the most beautiful flowering plants which have spread throughout England, and are to be found also in our own land, were brought from Palestine and Syria, and were first found in the extensive gardens of the monasteries. Among them were the wall-flower, the scarlet anemone or blood-drops of Christ, the blooming almond-tree, one of the symbols of the Virgin, and the marigold. These with many others found their place in art and are to be seen in illumin-

ated breviaries and in paintings, and were in high repute as preservatives from evil spells.

One of the most famous of these preservatives was the St. John's wort, or Hypericum. An old distich tells us that—

> Trefoil, vervain, John's wort, dill,
> Hinder witches of their will.

Baldur, the White God of the Norse Valhalla, was replaced in Christian days by St. John the Baptist. He was called the White Saint John in some old German and Gallic calendars. There are many relics of sun-worship still practised in Europe on St. John's day. Flowers with large sun-like discs were sacred to Baldur, and later to St. John the Baptist, and it was thus that the Hypericum obtained its name of St. John's wort and was believed to have especial power in repelling evil influences. From its handsome yellow flowers it obtained the name of the Rose of Sharon Boiled in wine or ale it was a popular remedy for spitting or vomiting of blood. In Norway red spots on the plant are called St. John's blood, and are supposed to make their appearance on the day of his beheading, August 29th.

The Ash tree, and particularly the Rowan, or mountain ash, had a like celebrity, and sprigs of the latter were sewn in the dresses of children to protect them from ill. Rustics in Scotland still take with them a branch of Rowan tree when going a-milking, to prevent witches from drying up the cows.

The Vervain, or Verbena, was also a sacred herb. It was gathered with certain observances, and this verse was repeated during the process:

> Hail to thee, Holy Herb!
> Growing on the ground;
> On the Mount of Olivet
> First wert thou found.
> Thou art good for many an ill,
> And healest many a wound;
> In the name of sweet Jesu
> I lift thee from the ground.

Other protecting plants were the Cyclamen, Pimpernel, Angelica, Bracken, Fern, Rue, Broom, Maiden-hair, Agrimony and Ground-ivy. Yellow or green flowers growing in hedgerows are especially repugnant to witches.

The Ash tree has a use in medicine which I fear is forgotten in these days. In the curious early Welsh book of treatment known as The Physicians of Middvai, written early in the 13th century, is a remedy for "Ulceration of the Ears," probably our otorrhœa. "Take the seed of the Ash, otherwise called the Ashen-keys, and boil briskly in the water of the sick man; foment the ear therewith, and put some therein on black wool." It is prudently added, "By God's help it will cure it." Black wool is an ingredient in many charms.

The English Folk-Lore Society recently published a reprint of a cutting from an old newspaper, without date, which describes the medical treatment of a woman who had been bewitched. It is a veritable curiosity in therapeutics, but it is to be thought that now-a-days we should call the affliction *hysteria*, and not bewitchment.

"They then gave to the said Magdalen Holyday the following medicines:—Imprimis, a decoction—ex fuga Daemonium (St. John's wort)—of Southernwood, Mugwort, Vervain, of which they formed a drink according to Heuftius' Medical Epistles, lib. xii., sec. iv., also following Variola, a physician of great experience at the Court of the Emperor. They also anointed the part with the following embrocation:—Dog's grease well mixed, four ounces; bear's fat, two ounces; eight ounces of capon's grease; four and twenty slips of mistletoe, cut in pieces and powdered small with gum of Venice turpentine, put close into a phial, and exposed for nine days to the sun till it formed into a green balsam, with which the said parts were daily anointed for the space of three weeks, during which time, instead of amendment, the poor patient got daily worse, and vomited, not without constant shrieks or grumbling, the following substances:—Paring of nails, bits of spoons, pieces of brass (triangular), crooked pins, bodkins, lumps of red hair, egg-shells broken, parchment shavings, a hen's bone of the leg, one thousand two hundred worms, pieces of glass, bones like the great teeth of a horse, a luminous matter, sal petri (not thoroughly prepared), till at length relief was found, when well nigh given up, when she brought up with violent retching, *a whole row of pins stuck on blew paper!* After that, these sons of Æsculapius joyfully perceived that their potent drugs had wrought the designed cure—they gave her comfort, that she had subdued her bitter foe, nor up to the present time has she been afflicted in any way; but having married an honest poor man, though well to do in the world, being steward to Sir John Heveningham, she has borne him four healthy children. . . . Whether this punishment was inflicted by the said old woman an emissary of Satan, or whether it was meant wholesomely to rebuke her for frequenting wakes, may-dances, and Candlemas fairs, and such like pastimes, still to me remains in much doubt. 'Non possum solvere nodum.'

P. S.—I hear the physicians followed up their first medicine with castory, and rad. ostrutii and sem. danci, on Forestius' his recommendation."

The radix ostrutii was, I suspect, the root of Imperatoria ostruthium, or Masterwort. It is regarded as a powerful stimulant and emmenagogue, and such was its reputation that it was termed *remedium divinum*. The *semina danci* must be a misprint for *semina dauci*, the seeds of the carrot, which were held to be diuretic and aromatic. Forestius's work, published in 1589, is a collection of curious cases with still more curious treatment.

The Elder-tree has been mentioned in some of the previous passages, and there were many strange superstitions connected with it. The "fox-headed Judas," as an old writer termed him, alluding to the color of his hair, was believed to have hanged himself upon an Elder tree, and that entirely credible writer, Sir John Maundeville, declares that he saw the veritable tree while in the Holy Land. There is a curious bit of folklore relating to the Elder, well known no doubt to the witches, who rode on broomsticks in their night journeys. Coles, in his "Art of Simpling," 1656, says:

"It hath been credibly reported to me from several hands, that if a man take an Elder stick, and cut it on both sides, so that he preserve the joynt, and put it in his pocket when he

rides a journey, he shall never gall." Richard Fleckno, in his Diarium, 1658, also tells us:

> How Alder-stick in pocket carried
> By horseman who on highway feared [fared],
> His breech should nere be gall'd or wearied,
> Although he rid on trotting horse,
> Or cow, or cowl-staff, which was worse.
> It had, he said, such vertuous force,
> Whose vertue oft from Judas came,
> (Who hang'd himself upon the same,
> For which, in sooth, he was to blame)
> Or 't had some other magick force
> To harden breech, or soften horse,
> I leave 't to th' learned to discourse.

In The Athenian Oracle, once edited by Samuel Wesley, brother of the famous John Wesley, is a confirmatory story. "A friend of mine," says the relater, "being lately upon the road a horseback, was extremely incommoded by loss of leather; which coming to the knowledge of one of his fellow travelers, he over-persuaded him to put two Elder sticks into his pocket, which not only eased him of his pain, but secured the remaining portion of posteriours not yet excoriated, throughout the rest of his journey."

It is much to be desired that this very valuable information should be made known to the members of the Hunt and to young cavalrymen going into the field.

In conclusion, it may be said as worthy of observation that the witches in Middleton's play, as well as those who figure in the other dramas from which quotations have been given, are of a somewhat vulgar type. Their purposes are purely malicious. Their names even are appropriate to their character. They are spoken of as Mother Bombey, Mother Demdike, Mother Sawyer, and the like. In Macbeth they are simply the "three weird sisters." The only one named is their queen, Hecate. They appear suddenly on the heath of Forres, in thunder and lightning, and after their fell work is done they vanish to aerial music. Their purpose, though malignant in the extreme, is of a lofty kind. They inspire Macbeth with ambitious hopes which lead him to the murder of the "gracious Duncan," and after a career of bloody tyranny end in his own destruction. There is in this the leading feature of the Grecian tragedy, that of irresistible fate. This is Shakespeare's method of handling the subject. The ordinary witch dreads the constable and the justice, but, as Charles Lamb observes, it would be "a hardy sheriff with the power of a county at his back, that would lay hands on the weird sisters."

In the play of The Witch of Edmonton, written conjointly by Rowley, Decker and Ford, there is a strong passage which, I think, must have been written by Ford. The witch has lost her familiar imp, who had been sent to perform some diabolic work, and she invokes his return thus:

> Not see me in three days?
> I'm lost without my Tomalin; prithee come;
> Revenge to me is sweeter far than life;
> Thou art my raven, on whose coal-black wings
> Revenge comes flying to me; O, my best love,
> I am on fire (even in the midst of ice)
> Raking my blood up, till my shrunk knees feel
> Thy curl'd head leaning on them. Come then, my darling.
> If in the air thou hoverest, fall upon me
> In some dark cloud; and as I oft have seen
> Dragons and serpents in the elements,
> Appear thou now to me. Art thou i' the sea?
> Muster up all the monsters from the deep,
> And be the ugliest of them: so that my bulch*
> Show his swarth cheek to me, let earth cleave,
> And break from hell, I care not: could I run
> Like a swift powder-mine beneath the world,
> Up would I blow it, all to find out thee,
> Though I lay ruin'd in it.—Not yet come?

The raven, alluded to in this passage, from his solemn hoarse voice and sable plumage, has been at all times regarded as a bird of ill omen. His croak announced approaching death. Marlowe, in his Jew of Malta, describes him as—

> The sad presaging raven, that tolls
> The sick man's passport in her hollow beak;
> And in the shadow of the silent night
> Doth shake contagion from her sable wings.

Lady Macbeth, sure of herself in the intended tragedy, exclaims:

> The raven himself is hoarse
> That croaks the fatal entrance of Duncan
> Under my battlements.

In the Korân (Sura V, 30-35, Sale) the raven is connected with the murder of Abel. Cain did not know how to conceal the body of his slaughtered brother, but, says the text, "God sent a raven, which scratched the earth to show him how he should hide the shame of his brother. And he said, 'Woe is me! am I unable to be like this raven, that I may hide my brother's shame?'"

The feathers of the bird had their appropriate uses, and Caliban in his curse exclaims:

> As wicked dew as e'er my mother brush'd
> With raven's feather from unwholesome fen,
> Drop on you both.

*Bulch, bulchin, an urchin, a hobgoblin.

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FURTHER OBSERVATIONS UPON THE TREATMENT OF MALIGNANT TUMORS WITH THE TOXINS OF ERYSIPELAS AND BACILLUS PRODIGIOSUS, WITH A REPORT OF 160 CASES.*

By Wm. B. Coley, M. D., *Attending Surgeon to the New York Cancer Hospital, Assistant Surgeon to the Hospital for Ruptured and Crippled.*

Abstract.

The cases reported extend over a period of upwards of four years, and they embrace nearly every variety of sarcoma and carcinoma. In practically all the cases the diagnosis was confirmed by microscopic examination made by the most competent pathologists. In addition, the majority of the tumors had been pronounced inoperable by leading surgeons, and in many cases still further evidence of malignancy was furnished by a history of repeated recurrence after operation.

It would seem possible from this large series of cases to arrive at some scientific opinion as to the value or worthlessness of the toxins in malignant tumors. The fact was emphasized that this method of treatment had been advocated only in inoperable cases which were entirely hopeless, not only from a surgical standpoint but also as regards any other hitherto known method of treatment. The author expressed the desirability of having these results subjected to the severest criticism. If they were able to stand this they would be of the greatest importance, not only as bearing upon the future treatment of malignant tumors, but also as throwing some light upon the unsolved problems of the etiology and pathology of such tumors.

An attempt was made to show that the method of treatment rested upon a rational basis, namely, the considerable number of cases of undoubtedly malignant tumors that had been permanently cured by attacks of accidental erysipelas. The writer's own observations covered the whole field from the accidental erysipelas to the mixed toxins. He was led to take up this line of investigation from having observed a small, round-celled sarcoma of the neck, five times recurrent, and given up as hopeless, cured by an attack of accidental erysipelas, patient having been found alive and well seven years afterward. His first series of ten cases were treated with repeated injections of living bouillon cultures, with the view of producing erysipelas. The unmistakable improvement that followed the repeated injections, even when no erysipelas was produced, especially in sarcoma, suggested that a portion, if not all of the beneficial influence was due to the toxins instead of the living germ, and this led to experiments with the toxins alone.

The first experiments were conducted with bouillon cultures that had been subjected to 100° C. and were used without filtration. The reactions following the injections of this solution were similar in character to those obtained from injections of the living germ, although less severe. In order to increase the virulence of the cultures, the writer made use of the fact demonstrated by Roger, that the bacillus prodigiosus, a non-pathogenic organism, had the power of intensifying the virulence of the streptococcus of erysipelas. The toxic products of the two germs were prepared separately and mixed at the time of using.

This mixture produced a much more severe reaction than when the erysipelas was used alone, and the beneficial influence upon the tumor was likewise more marked. Later on, at the suggestion of Mr. B. H. Buxton, the two germs were grown together in the same bouillon, the erysipelas being grown alone for 10 days and the bacillus prodigiosus added and the two allowed to grow together for another week or 10 days, at the end of which time they were passed through a Kitasato filter. This appeared to be a still greater improvement in technique.

A still further change was made with a view of utilizing whatever of value might exist in the insoluble products remaining in the dead germs; the cultures were heated in a temperature sufficient to render them sterile, which was found to be 58–60° C. for one hour. By the addition of a little thymol the fluid could be kept indefinitely in glass-stoppered bottles. This preparation was much stronger than those before described, and experience proved it to be much superior to the others in its action upon the sarcoma. An analysis of the cases treated showed that 48 were round-celled sarcoma, 13 spindle-celled, 7 melanotic, 2 chondro-sarcoma, 3 mixed celled, 14 sarcoma, special type not known. Total number of cases of sarcoma 93; carcinoma and epithelioma 62 cases; sarcoma or carcinoma 10; tubercular 2; fibro-angioma 1; mycosis fungoides 1; goitre 2; keloid 1. Of the cases of sarcoma, nearly one-half showed more or less improvement; the variety that showed the greatest improvement was the spindle-celled; that which showed the least, the melanotic. Next in order of benefit was the mixed celled—round and spindle; then round-celled, while osteo-sarcoma closely approached the melanotic in showing but little change. In a series of 9 cases of melanotic sarcoma, no improvement was noticed in 6, very slight in 3. Most of the cases of osteo-sarcoma failed to respond to the treatment, many showed slight improvement, and one case, a very large osteo-chondro-sarcoma of the ilium, apparently disappeared and the patient remained well for nearly a year, when a recurrence occurred. One case of round-celled sarcoma of the neck of very rapid growth showed very marked decrease during the first week's treatment, after which time it continued to grow in spite of large doses of the toxins.

Report of Successful Cases.

The cases most worthy of especial note were the following:

Case I.—A twice recurrent inoperable sarcoma of the neck with large secondary sarcoma of the tonsil.

Last operation performed by Dr. Wm. T. Bull, March, '91. The tumor was so extensive that only a portion could be

* Paper read at the meeting of the Johns Hopkins Medical Society, April 6, 1896.

removed; the general condition of the patient, May 4, 1891, was so bad that he was expected to live but a short time. He could swallow no solid food, and liquids with difficulty. He was treated from May 4 until October 8, 1891, with repeated local injections of living cultures of streptococcus of erysipelas; decided improvement followed the injections, and whenever they were discontinued for a short time the growth increased in size. On October 8 a severe attack of erysipelas was produced by using a new and more virulent culture. During this attack the tumor of the neck nearly disappeared, the tumor of the tonsil decreased in size; general condition of the patient rapidly improved and he had soon regained his usual health and strength. He has had no treatment since. He was last seen in September, 1895, four years later, at which time the tumor of the tonsil, though still present, had greatly shrunken in size; there was a small mass at the site of the old scar in the neck, apparently made up of cicatricial and fibrous tissue.

Microscopic Report.

[Copy from Records, N. Y. H. Laboratory.]

Spec. No. 1870.—Report of Microscopical Examination.

Operation, a piece of tumor about the size of an orange was removed, but a portion yet remains, being too deeply seated for extirpation.

Microscopically the tumor is composed of fibrous tissue and spindle cells, the fibrous tissues predominating in places and in others the spindle cells.

There are many areas of cells resembling mucous cells, and not to be differentiated from myxomata; vascular supply abundant and vessel walls formed by tumor tissue.

Diagnosis, "myxo-sarcoma."

Farquhar Ferguson, M. D.,
Pathologist to the New York Hospital.

Case II.—Large recurrent sarcoma of the back and groin; entire disappearance of both tumors; patient in perfect health, without recurrence four years after the beginning of the treatment, and more than three years after the cessation of the treatment.

Patient male, aged 40; sarcoma of the back and lower lumbar region 7x4 inches, with a secondary tumor the size of a goose-egg in the groin. The groin tumor was removed by operation, January, 1892; it rapidly recurred. Patient was examined by Dr. Wm. T. Bull and several other surgeons, who all regarded the case as inoperable. Diagnosis of sarcoma was made and confirmed by Dr. Farquhar Ferguson's (pathologist to the New York Hospital) examination of a portion removed under cocaine.

Treatment by repeated daily injections of living bouillon cultures of erysipelas was begun in April, 1892. At the end of two weeks a severe attack of erysipelas was produced. At the end of three weeks both tumors had entirely disappeared. Recurrence followed in July, and the tumors, both in the back and the groin, grew more rapidly than before. The injections were resumed, and between October, 1892, and January, 1893, the patient had four additional attacks of erysipelas; they were milder in character, and the effect upon the tumor was less striking.

In January, 1893, the tumor in the back was removed, but that in the groin left undisturbed. At the end of three weeks there was an apparent recurrence in the back, and the injections with the mixed toxins of erysipelas and bacillus prodigiosus were then begun. Both tumors quickly disappeared. Treatment was discontinued in March, 1893; patient has been in perfect health, free from recurrence since.

Pathological Report.

[Copy from Records, N. Y. H. Laboratory.]

The tumor is a sarcoma, in which the cells are round, oval, and spindle, in which everywhere there is seen a stroma of fibrous tissue, apparently the remains of the subcutaneous tissue which has not been completely destroyed during the development of the tumor. Yellow elastic fibres are quite abundant throughout the tumor, but the vascular supply is not very abundant.

Farquhar Ferguson, M. D.,
Pathologist to the New York Hospital.

Case III.—Large inoperable sarcoma of the abdominal wall and pelvis; entire disappearance of the tumor; no recurrence three years after.

The patient, a boy of 16 years of age, had a tumor 7x5 in. in extent, involving apparently the entire thickness of the abdominal wall, attached to the pelvis, and judging from the symptoms and position, evidently involving the wall of the bladder. A portion of the tumor was removed, and pronounced spindle-celled sarcoma, by Dr. H. T. Brooks, pathologist of the Post-Graduate Hospital. The case was regarded as inoperable by Prof. L. Bolton Bangs and referred to Dr. Coley for treatment with the toxins. Patient was admitted to the N. Y. C. H., Jan., 1893, treated for three months with the mixed filtered toxins. At the end of that time the tumor had nearly disappeared, and the remainder was gradually absorbed after the injections were discontinued; there was no breaking-down of the tumor tissue; patient has been in perfect health up to the present time, more than three years after cessation of treatment.

Pathologist's Report.

Spindle-celled sarcoma.

H. T. Brooks, M. D.,
Pathologist to the Post-Graduate Hospital.

Case IV.—Large inoperable sarcoma of the abdominal wall; entire disappearance; no recurrence 2½ years afterward. The patient a woman, 28 years of age.

Exploratory operation had been performed in August, 1893, by Dr. Maurice H. Richardson, of the Massachusetts General Hospital. The tumor was too large to be removed; a portion was excised for microscopic examination. The diagnosis made by Dr. W. F. Whitney, pathologist to the hospital, was fibro-sarcoma. The patient was sent to Dr. Coley by Dr. Richardson for the erysipelas treatment. The injections with the mixed toxins were begun in October, 1893, and continued for 10 weeks; the tumor entirely disappeared. The patient is still in perfect health, with no trace of recurrence.

Pathologist's Report.

August 31, 1893.

The specimen from the tumor of the abdominal wall (Mrs. L.) was a small, dense, ill-defined, whitish, fibrous-looking mass, which

on microscopic examination was found to be made up of large numbers of small cells with a tendency to form fibres. This latter condition was more marked in some places than others. The diagnosis is fibro-sarcoma. W. F. WHITNEY, M. D.,

Pathologist to the Massachusetts General Hospital, Curator Warren Museum, Harvard Med. School.

Case V.—Spindle-celled sarcoma of the leg. Popliteal region. Three times recurrrent. Disappearance. Recurrence in gluteal region after one and a half years.

The patient, a girl, 15 years of age, had undergone three operations by Dr. Wm. T. Bull, for spindle-celled sarcoma starting in the metatarsal bone. In January, 1894, a tumor the size of a child's head was removed from the popliteal region. The one in the stump, the size of a hen's egg, was left to test the value of the toxins. Complete removal of the tumor in the popliteal region was impossible. The toxins were administered at the N. Y. H., under Dr. Bull's direction, for about 2 months; treatment was continued at the N. Y. Cancer Hospital by Dr. Coley. The indurated mass in the calf slowly disappeared; tumor in the stump also disappeared.

Patient remained well for 1½ years. At the end of that time there was a recurrence in the gluteal region. The toxins were again administered; the tumor diminished in size, and in February, 1896, was removed.

Pathological Report.

Tumor the size of a child's head, measuring 9x7x4½ centimeters, is partly surrounded by a smooth capsule, but presents many freshly incised surfaces; whitish in color; very firm; of little vascularity, and presenting the appearance of fibro-sarcoma.

Microscopic examination of the tumor shows the typical structure of a fibro-sarcoma, with sarcoma elements predominating; vascular supply fairly predominant. F. FERGUSON, M. D.,

Pathologist, New York Hospital.

Case VI.—Extensive spindle-celled sarcoma of the scapula and chest-wall; entire disappearance of the tumor under three months' treatment; patient at present in perfect health; no trace of recurrence 23 months later.

The patient, a girl, aged 16 years, was admitted to the "incurable ward" of the New York Cancer Hospital on June 20, 1894. The tumor apparently started in the region of the left scapula, 4 months before, and extended to the vertebral line behind, and in front to the edge of the sternum; it was fixed to the chest-wall, measured 13 inches behind, 7 inches in front. The left arm was bound down by the new growth so that it could not be raised to a horizontal position; the skin was normal; there were no general or local signs of inflammation. A portion of the tumor was removed for microscopic examination and a diagnosis of typical spindle-celled sarcoma was made by Dr. H. T. Brooks, pathologist to the Post-Graduate Hospital. The patient was treated for three months with daily injections of the mixed unfiltered toxins; improvement was immediate and the tumor very rapidly disappeared by absorption. Patient remains in perfect health at the present time.

Pathologist's Report.

Typical spindle celled sarcoma.

H. T. BROOKS, M. D.

Pathologist to the Post-Graduate Hospital.

Case VII.—Intra-abdominal round-celled sarcoma of mesentery and omentum; disappearance; patient well, without evidence of recurrence 1½ years later.

The patient, female, aged 23 years, was operated upon by Dr. Willy Meyer at the German Hospital, in August, 1894. A small tumor involving the mesentery, omentum, large and small intestine, was found and removal considered impossible. Portion was excised for examination and pronounced by Dr. Schwytzer, the pathologist of the German Hospital, "round-celled sarcoma." Patient was referred to Dr. Coley for treatment with the toxins. Injections were given in the gluteal region and abdominal wall for about six months, with occasional intervals. In February, 1896, an attempt was made to close the sinus in the abdominal wall which had persisted since Dr. Meyer's operation. The sinus was found to lead into the gall bladder and several impacted gall-stones were removed; careful exploration of the abdomen failed to reveal the presence of any tumor. Patient perfectly well, August 7, 1896.

Case VIII.—Epithelioma of the chin, lower jaw and floor of mouth; entire disappearance; patient perfectly well two years later.

The patient, a woman 34 years of age, was admitted to the Methodist Episcopal Hospital in May, 1894. A rapidly growing tumor was found, involving lower jaw, floor of mouth and soft part of the chin, extending over an area about the size of a silver half-dollar, presenting the appearance of a typical epitheliomatous ulcer. The patient was regarded as inoperable by Dr. Geo. R. Fowler; a portion of the growth was excised and diagnosed as epithelioma, by Dr. Wm. N. Belcher, pathologist to the hospital. The patient was treated at the N. Y. C. H. from June, 1894, till September, 1894, with the mixed unfiltered toxins. There is no trace of the tumor to be found at present and the woman is in perfect health (July, 1896).

Pathologist's Report.

Material from chin and lower jaw, May 20, 1894. Sections were not entirely satisfactory, but from gross appearance of the materials and those revealed by the microscope the diagnosis of epithelioma is offered. W. N. BELCHER, M. D.

Case IX.—Enormous osteo-chondro-sarcoma of the ilium; tumor disappeared; patient regained his usual health and remained well for seven months, at which time a recurrence occurred. The tumor has resisted further treatment; the patient, although alive, is in a hopeless condition.*

Case X.—Spindle-celled sarcoma of the hand, 6 times recurrent; remained well for one year, then recurred.

Case XI.—Very large, twice recurrent angio-sarcoma of the breast; treated for six months with the erysipelas and prodigiosus serum; marked reduction in size, making the tumor easily removable; excision, September, 1895; no recurrence, February 8, 1896.

The patient, a woman aged 59 years, was admitted to the N. Y. C. H. on January 20, 1895; had a very large recurrent tumor in the region of the left breast, extending from the sternum to the mid-axillary line; the tumor was fixed to the

* Patient died, July, 1896.

chest-wall, and entirely inoperable; patient was extremely weak. She improved slowly under the local injections of the erysipelas serum, and in September the tumor had become so much reduced that it was easily excised.

Microscopical Report.

I have examined a large number of sections from different parts of the tumor of breast of No. 207, and although there is considerable diversity in detail of the new growth in different parts, I think that the structures are all referable to the type of angio-sarcoma, which accordingly is the anatomical diagnosis.

T. Mitchell Prudden, M. D.

Case XII.—Large inoperable round-celled sarcoma of the iliac fossa; treatment was begun in June, 1893; tumor almost entirely disappeared; patient was in good health, August, 1894, after which time he was lost sight of.

Case XIII.—Probable sarcoma of the sacrum; disappearance of tumor; complete restoration to health.

The patient, male, 38 years of age, began to lose flesh and strength in February, 1895. Later had severe pains in lower portion of the spine and sacrum, shooting down the legs. April 1, began to get lame in the right leg; soon after in the left; all of the symptoms progressively increased, and on the 2d of May his weight had fallen from 175 to 134 pounds. He was admitted to Dr. Kinnicutt's service at St. Luke's Hospital; rectal examination showed a tumor, hard in consistence, attached to the anterior portion of the sacrum, the lower portion of which only could be reached with a finger. Clinical diagnosis of Dr. Kinnicutt and the others who saw the patient in consultation was inoperable sarcoma. No microscopic examination was made. A two to three weeks' trial with the erysipelas toxins was advised by Dr. Coley. The improvement was almost immediate; injections were made into the buttocks; treatment was repeated daily, and at the end of one week the excruciating pain had almost entirely subsided, the lameness improved rapidly, and at the end of six weeks the patient had gained 28 pounds and was able to resume his work. Examination, March 8, 1896, showed the patient to be in perfect physical health; his lameness had disappeared; no trace of a tumor could be detected on rectal examination; his weight at that time was 175 pounds.

Several other cases in which very marked improvement had followed the use of the toxins were reported.

Attention was further called to nine successful cases in the hands of other surgeons who had used this method. The most important of these were the following:

Case 1.—A large spindle-celled sarcoma involving almost the entire palate and pharynx.—This case, it was stated, had already been reported in the New York Medical Record, November 17, 1894, but its value was greatly enhanced by the fact that there had been no recurrence two years afterwards.

Case 2.—Extensive inoperable intra-abdominal sarcoma, reported by Dr. Herman Mynter of Buffalo, in the New York Medical Record, February 9, 1895. In this case the tumor disappeared, and up to April, 1896, there had been no recurrence.

Cases 3–6.—Drs. L. L. McArthur and John E. Owen of Chicago had had three successful cases, although sufficient length of time had not elapsed to determine whether or not they could be classed as cured. All of the cases were recurrent, and in two amputation of the leg had been advised; in a third, amputation of the arm.*

Case 7.—Czerny of Heidelberg, who has used the method in four cases of sarcoma and in four of carcinoma, has reported one case of rapidly growing, inoperable, round-celled sarcoma of the parotid which nearly disappeared under the influence of 18 injections. The case has been more recently referred to as cured, by Glueckmann.

Case 8.—Dr. Judson C. Smith, of the Post-Graduate Medical School, had a case of small round-celled sarcoma of the neck, the size of an orange, disappear entirely under eight weeks' treatment with the mixed toxins. Microscopic examination was made. Patient gained 25 pounds in weight, remained well for a number of months, at the end of which time a recurrence took place.

Cases 9–10.—Two other successful cases were briefly reported, both of which were confirmed by microscopic examination; both cases were recent, and therefore could not be classed as permanent cures.

The writer stated that he did not expect the profession at large to accept without question and criticism such remarkable results as he had reported, and for that reason he had related with some detail the successful cases in the hands of other surgeons who had employed this method. He was of opinion that a series of upwards of 20 successful cases of inoperable sarcoma (four of which had remained well upwards of 2½ years), the diagnoses of which had been established beyond question according to accepted methods of diagnosis, ought to be sufficient to demonstrate the real and positive advance that had been made in a field which, up to this time, had been regarded as absolutely hopeless. He did not doubt that there were those who would still remain skeptical about the value of the toxins in spite of the evidence presented. Such persons must either fail to see any logical connection between the accidental erysipelas and the toxins, or they must go even farther and deny that there are any authentic cases of malignant tumors that were cured by accidental erysipelas. The only explanation they can have to offer for the results which cannot be questioned is, that in all the successful cases there must have been an error of diagnosis.

Such an explanation might be entitled to some consideration were a single case only involved, but those who would seriously propose it as a satisfactory explanation in view of the results in more than 20 cases, could not claim to be guided by scientific principles. The writer stated that he had carefully examined the literature of the subject of spontaneous disappearance of tumors supposed to be malignant, but had failed to find a single instance in which the diagnosis had been confirmed by the microscope. It would appear remarkable that these cases should be the first on record with a clinically and microscopically confirmed diagnosis to disappear spontaneously, and it would seem more remarkable still that this disappearance should be coincident with the beginning of the treatment with the toxins.

*In two of these cases there was a suspicion of recurrence in April, 1896.

Furthermore, it would be clearly unfair to rule out these cases on the ground of error in diagnosis, without ruling out the cases of cure following operation, for the same reason.

The writer then briefly referred to the various theories that had been offered in explanation of the action of the toxins. He still adhered to his opinion, expressed in his earlier paper, published in December, 1892, that the micro-parasitic origin of malignant tumors furnished the only rational explanation of this action. His conclusions were, 1) that the mixed toxins of erysipelas and bacillus prodigiosus exercise an antagonistic and specific influence upon malignant tumors, which influence in a certain proportion of cases may be curative. 2) That the influence of the toxins is very slight in most cases of carcinoma, including epithelioma, most marked in sarcoma, but that it varies greatly with the different types, the spindle-celled form being by far the most responsive to the treatment. 3) That the action of the toxins is not merely local in character, but systemic. 4) That the toxins should be reserved for use in clearly inoperable cases of sarcoma, or in cases after primary operation, to prevent recurrence.

Discussion.

Dr. Welch.—I have been very much impressed by this personal statement from Dr. Coley, and I see no way of gainsaying the evidence which he has brought forward, that there is something specifically and genuinely curative in his method of treatment. A single undoubted cure of a demonstrated cancer or sarcoma by this treatment would be enough to establish the fact that the treatment exerts some specific curative effect, for the spontaneous disappearance of undoubted malignant growths of this character is almost unknown. Dr. Coley has, however, presented to us positive proof of the cure, not of one only, but of several cases of malignant tumor by his method. Although I suppose that in any given case the chances of cure by this method are at present not great, still the demonstration that cure is possible gives every encouragement for perseverance in this line of investigation and work, and for efforts to perfect the method of treatment.

It is interesting to learn that the most strikingly beneficial results have been obtained in the treatment of spindle-celled sarcomata. There are certain kinds of sarcomata which some pathologists are inclined to rank rather among the infectious tumors than among the genuine tumors, in the sense in which these terms are used by Cohnheim; but it is rather certain sarcomata of the lymphoid type than the fusiform-celled sarcomata which are thus believed to be possibly outside of the class of genuine tumors, according to Cohnheim's classification.

As Dr. Coley suggests that the variations in his results may depend in part upon variations in the virulence of his cultures, and as it is well known that streptococci vary notably in virulence, I would like to ask if he has as yet utilized the methods of Marmorek in order to obtain cultures of uniformly high degrees of virulence. Dr. Livingood in my laboratory has confirmed the results of Marmorek and succeeded repeatedly by his method in transforming streptococci of low virulence into those of very exalted virulence.

It seems to me that it would be practicable and most interesting, and possibly demonstrative of the specific effects of the treatment, if Dr. Coley, in carrying out his researches, would occasionally cut out small bits of tissue from the tumor and by their examination endeavor to determine the details of the process of cure.

It does not seem to me absolutely necessary to adopt the hypothesis of the parasitic causation of these malignant growths in order to explain their disappearance under this treatment. It is conceivable that the peculiar biological properties of the tumor cells—and peculiar they unquestionably are—may render them particularly susceptible to the toxic substances injected. The evidence that the curious bodies often seen in malignant tumors are genuine parasites is, in my opinion, far from conclusive at the present time.

Dr. Finney.—I have had the opportunity of observing the action of both the erysipelas organism and the toxin in a number of cases, both in hospital and private practice. One point which Dr. Coley has not mentioned to-night, but which he has referred to previously, I will speak of, because I think it of great value. It is the influence of the treatment on cases which may not finally result in a cure. The first case in which I used the erysipelas occurred about the time Dr. Coley began to make his observations in New York. It was a case of a woman with inoperable carcinoma of both breasts. Against my will, but at the urgent request of herself and her husband, I inoculated with a pure culture of the erysipelas streptococcus. She had at the time a very distressing and severe cough, with intense pain, evidently from involvement of the pleura. She had also evidences of internal metastases. After the first reaction from the erysipelas the pain almost entirely disappeared, and did not reappear with severity while the patient lived. She had been almost constantly under the influence of morphia up to the time of the inoculation, and after that time she had only a little codein from time to time to relieve her cough, which persisted after the pain had disappeared. I observed a similar action in another case. I think this patient lived three months after the inoculation. She gradually wasted away, more from inanition resulting from the internal metastases.

I had one case of inoperable carcinoma of both breasts, in which it was impossible to produce any reaction from the erysipelas. I injected it under the skin, I scarified and dressed the wounds in pure cultures in large amounts in very virulent erysipelas without getting the slightest reaction. Of course there was no result from this case.

I would like to ask Dr. Coley whether he has ever observed any cumulative effect of the toxins? In one or two cases it seemed as if that had happened. After a number of injections with gradually increasing doses, without any reaction, a sudden tremendous explosion would take place which slowly subsided, and then for a varying length of time there would be no reaction, even with larger doses than were used previously.

I have observed no cases up to the present time where there has been a cure. But unfortunately, all the cases in which I have used it, except one under treatment at the present time, have been either carcinoma or cases of sarcoma that were beyond hope from any source.

Dr. Coley.—I have been very much interested in the discussion and I think I have gained as much from it as any one. I was particularly interested in the remarks of Dr. Welch. I did not mean to make quite so strong a statement in regard to the parasitic theory; I should have said that that was the way it appeared to me.

I have used the streptococcus from all sources, but the streptococcus from a virulent case of erysipelas seems to have a better effect than a streptococcus from an abscess.

I have used Marmorek's method somewhat. Mr. Buxton has repeatedly passed the cultures through rabbits, and he had been doing it for some time before Marmorek's paper came out. That is the way, I believe, in which improvement in technique is to come, along the lines which Marmorek has shown us, in increasing the virulence of the cultures.

I will say, in answer to Dr. Bloodgood's question regarding metastases, that the patient with sarcoma of the back and groin was a case of marked metastases, the tumor being the size of a goose egg and also recurrent in the groin. That case has remained well over three years since the cessation of treatment.

A case which I published a year ago, treated by Dr. Rumgold of San Francisco, was one in which a round-celled sarcoma reappeared eight times in the breast. It disappeared under the mixed toxins, but the patient died a few weeks later. Autopsy showed very extensive metastatic deposits in the internal organs. In this case the external growth had been cured, but the internal growths were too far gone to be influenced.

About removing specimens during the course of the treatment, as suggested by Dr. Welch, I will say that I have done that in a considerable number of cases. In many of these cases a marked fatty degeneration and necrosis of the malignant cells were clearly visible under the microscope. I shall try to show these changes in micro-photographs of the sections.

In regard to intra-orbital sarcomata, I have not had an opportunity of treating such cases before removal of the eye. I have had four or five cases of recurrent tumors in the orbit after the eye had been enucleated. The effects were very slight, if any. They were all melanotic or round-celled sarcomata.

As to the safety of the treatment, I think that if the cases are selected with some judgment the injections can be used with almost perfect safety. I have had three cases in which I am sure death was hastened by the use of toxins. In one case I ought not to have used the treatment. There was an enormous sarcoma of the scapula and chest wall. The patient was so much emaciated that he could not have lived more than a couple of weeks, but with two very minute doses of the weaker solution of the toxins he lived only three days.

The differences obtained by the same doses at different times is best explained, I think, not by cumulative action, because that is not clearly proven, but by the fact that the reaction is greatly increased when the injection is made into a more vascular part. A patient can stand perhaps five to ten times as much injected subcutaneously remote from the tumor as he can injected into a vascular tumor. Sometimes we inject into a part that is more vascular than others, and to this is to be attributed the difference in reaction. I always caution any one to begin with the minimum dose and increase it very gradually. One half a minim of the unfiltered mixed toxins is sufficient for the initial dose.

THE PSYCHICAL NERVE CELL IN HEALTH AND DISEASE.*

By Henry J. Berkley, M. D.

The cortex of the brain of all mammals contains a large variety of different forms of nerve cells. Among these, and perhaps three-quarters of the whole number, are certain cells of peculiar form and character which are not present in other parts of the nervous system, and probably subserve as the substratum of the mental functions, and accordingly they have been named the *psychical* nerve cells.

Of these cells there are two varieties—a small and a large form—only differing anatomically in their size, the other characteristics being equal. The small cells occupy the region of the cortex comparatively close to the surface of the brain, the others are more deeply situated.

The body of the cells is of pyramidal or conical form. Out of the superior portion departs what is known—from its early origin—as the primordial process, which at some distance from the cellular body branches and rebranches until it assumes the outspreading appearance of a tree. Out of the basal portion of these cells also proceed extensions, which correspond to the roots of the tree, and may be either few or many in number.

The uppermost branches of the psychical cells reach high up into the outer lamina of the cortex, where they come into contiguity with the endings of the very numerous nerve fibres that arise from the medullated masses at the foot of the convolutions, or have their source within the cortical layers and ascend toward the brain surface.

So far, except in shape, the psychical cells do not differ from other nerve cells in the brain-rind, but if we look a little closer at the branches of the neurons, we will find that they are thickly studded with short lateral projections, the majority of these having the form of a round-headed pin with the sharp point set into the protoplasmic substance of the stems. These peculiar lateral projections, or gemmulæ, are present to some extent on other cortical cells, but have not the full development they possess with the psychical, and accordingly it is reasonable to suppose they have peculiar attributes differing from other cells.

Let us consider for a moment their probable function. Surrounding the branches or dendrites of the cells is a maze of

* Read at the Ninety-eighth Annual Meeting of the Medico-chirurgical Faculty of the State of Maryland, April 28, 1896.

innumerable fine nerve fibres, and from these filaments are given off at frequent intervals, which, after branching and rebranching a number of times, end in little bulbs that constitute the intracortical end-apparatus of the nerve fibres. Now these little bulbar endings come into very close approximation with the globular ending of the gemmules, and it is exceedingly probable that the nervous forces passing from cell to cell, or the external impressions conveyed centralwards from the peripheral organs to the nerve centres, overleap the slight barrier between the ending of the nerve fibre and the bulbous ending of the gemmule, and through the medium of the latter are continued on toward the cell body, where, acting as a temporary irritant, they excite the cells to action, and a thought or motor impulse is engendered.

Besides the protoplasmic processes, another even more important portion of the psychical cell has its origin in the basal region. The axon, or axis cylinder, invariably departs from this end, usually in the form of a thin cone which gradually attenuates until it becomes the axis cylinder. On its way toward the white medullated matter the axon gives off a number of side branches or collaterals. These invariably return toward the surface of the brain, and after a number of subdivisions, end in the bulbar apparatus before described, and serve the purpose of connecting one cortical psychical neuron with a large number of others situated in its immediate neighborhood.

Thus it is found that the cortical neurons not only receive impressions from more distant sources, intrinsic or extrinsic to the brain, but that one cell receiving the dynamic force may communicate it to dozens of other cells, and that a considerable excitation of numerous neurons may result from what was in the first place an excitation of inconsiderable moment, for in fact the whole mass of cells in the cortex of the brain are so intricately united one with another by the complicated arrangement of fibres and collaterals that the brain-rind may be considered as an unit, at least such is the present idea derived from a study of its minute anatomy by the silver methods now in vogue.

We have seen the form and connections of the psychical cell in health, let us turn for a moment and see its deportment under certain pathological conditions.

I have studied during the past few months the effects of the action of certain poisons upon the cortical cell, notably the effects of alcohol, of the poison derived from the castor-oil bean, ricin; and for the toxins of bacterial source that developed in experimental hydrophobia. All possess the quality of destroying the protoplasm of the nerve cell and annulling its functions, some with extreme rapidity, some more slowly. All act upon the living substance of the cell in a similar manner, the process being one of a peculiar type of parenchymatous degeneration.

In the earliest stages of the degenerative process, or where the amount of the poison circulating through the blood-channels is but small in amount, we find the changes confined to the fine free extremities of the dendrons, principally in the outermost layer of the cortex, where the branches of the psychical cells have their endings. On these fine branches, in the place of the smooth rounded contours of the stems, one finds they have acquired a number of knots or tumefactions in their course, and over the site of these swellings the round-headed gemmules are beginning to show signs of disease. They no longer assume the full black staining from the silver, but appear light-colored, and besides are, owing to the swelling of the stems, pushed further apart than is natural.

A stage further in the process shows an increase in the number of the tumefactions. They also extend further downward on the stems. The gemmules are now beginning to drop off from the branches, are being taken up by the lymphatics, and rapidly disappear. Soon the finer branches begin to atrophy and disintegrate, they dwindle and drop off from the thicker stems, or are reduced greatly in length, and the portions remaining are thickly set with swellings of smaller or larger size, from which the gemmules have almost entirely disappeared.

As the irritation of the protoplasm of the nerve cell continues, the destruction becomes more and more intense, the long apical and basal branches are reduced to knotted stumps, scarcely retaining anything of their former aspect; eventually the remaining portions of the neuron, now reduced to the corpus and axon, become involved in the retrogressive process; the body also begins to break up, but as it is extremely resistant to the effects of the toxin, it is a long time before actual disintegration takes place and it is removed by the lymph currents.

The axis cylinder seems to be the most resistant portion of the cell to the destructive influences of irritant poisons; long after the other portions of the neuron have attained a considerable degree of degeneration, it retains its fine rounded thread unswollen, and apparently uninfluenced by the morbid process going on in the other members. The collaterals and terminal apparatus retain their normal form until the destruction of the cell has been completed. The only disease in which there is an exception to the rule of the continuance of the axon is in hydrophobia, where a few cylinders may now and then be seen to have spindle-like thickenings in their course.

Synchronous with the degeneration of the protoplasmic twigs of the neuron, interesting changes take place in the nucleus. The nucleolus, as well as the coarser molecular particles contained in the nuclear ring, swell and form rounded or irregular corpuscular bodies that occupy a large portion of the circle. The nuclear substance also shows altered properties, it absorbs more of the aniline dye, and no longer shows the usual disposition of the molecular particles found in health. Even in the second stage of the degeneration, when the cellular branches are tumefied and the gemmulæ are dying, the cells are practically incapable of functioning, for their connection with other neighboring or more distant neurons is already broken, and they can no longer receive the nervous impressions transmitted from other elements, and any impulses originating within their corpora must be perverted ones, and more likely to be the source of irregular muscular contractions than of perfectly coordinated movements; in fact we do find these very incoordinate motions in many cases of severe poisoning with toxins, especially those of bacterial source.

In the tumefactions of the dendrites of the nerve bodies and loss of the gemmulæ, the connecting link between the

terminal fibre apparatus and nerve cell is broken, and one can readily see in the loss of the anatomical relations an explanation of the numerous dementias and mental obtundities that follow a not inconsiderable proportion of cases of infectious fevers.

The pathology of a number of chronic insanities seems to depend largely on the condition of the protoplasmic branches of the nerve cells and of their adherent gemmules. In various forms of dementia there is a distinct diminution in the numbers of these little appendages to the neuron, together with reduction of the calibre of the stems. In some cases of idiocy I have found a pronounced lack of development of the gemmules, and accordingly deficiency in the number of points on which external impressions may be received by the central cell, hence the mental slowness and obtundity.

THE FREQUENCY OF CONTRACTED PELVES IN BALTIMORE.*

By J. Whitridge Williams, *Associate Professor of Obstetrics, Johns Hopkins University.*

Five years ago I wrote a short article, entitled Pelvimetry for the General Practitioner,[27] in which I endeavored to show that pelvic mensuration was grossly neglected in this country and that our obstetrics suffered severely in consequence.

At the present time, I am glad to say, far more attention is being paid to it, and students generally are taught that it should constitute an important part in the examination of the pregnant and parturient woman.

In the article referred to, after discussing various aspects of the subject and urging that pelvimetry be made an integral part of the first obstetric examination, I stated: "Any one, who will regularly pursue this course, will be amazed to find how many moderately contracted pelves do exist, and will then be able to explain, in a rational way, many difficult cases of transverse or other presentations, which previously he merely turned or delivered by forceps or cranioclast, and whose abnormal presentation or mechanism he ascribed to some freak of nature rather than to a rational and sufficient cause."

Since the opening of the Out-door Obstetrical Department of the Johns Hopkins Hospital, a little more than a year ago, external and internal mensuration of the pelvis has been made an integral part of the examination of every pregnant or parturient woman who applies for aid, and the results have amply substantiated the prediction just quoted.

Up to March 15, 1896, we have collected the measurements of one hundred women, nearly all of whom were examined several times during the course of pregnancy, while a few were examined only at the time of labor. It is to the results of these observations that I desire to direct your attention.

I might say, in passing, that all the women were examined by Dr. Geo. W. Dobbin, the Assistant Resident Obstetrician of the Hospital, but in almost every case mentioned in this article the examination was also controlled by me, so that there is no reason to attribute any of the cases to faulty pelvimetry.

The study of pelvic contraction is of comparatively recent date. Until the sixteenth century, absolutely nothing was known concerning it; it being supposed that the pelvic bones separated during labor, and that any obstacle to the birth of the child was due to resistance offered by the soft parts.

As the first accurate description of the pelvis was given by Vesalius (1514–1564), any idea as to abnormal pelves was impossible before that period. And it was not until after his death that one of his pupils, Julius Caesar Arantius[1] (1530–1589), described the first recognized case of contracted pelvis. The teachings of Arantius, however, exerted but little influence, and the earlier uncertainty concerning the normal anatomy of the pelvis continued for many years, and naturally the doctrine of contracted pelvis remained undeveloped.

It appears from a careful perusal of the works of the great Mauriceau[16] that he recognized contracted pelves in only two cases; one of them being the case upon which Hugh Chamberlen attempted to illustrate the advantages of the forceps invented by his uncle, and so ignominiously failed.

It was not until the first part of the eighteenth century that the doctrine of contracted pelvis began to exert any influence upon obstetrical practice, when Heinrich van Deventer,[3] in his "New Light for Midwives," described the flat and generally contracted pelves, and demonstrated their effect upon the course of labor. Since then the doctrine of contracted pelvis has never been lost sight of, and nearly all the greatest names in obstetrics are associated with its rise and development.

The great Smellie[24] played an important part in this regard, and his teachings exerted great influence. It is only necessary to recall the fact that he originated the method of manual mensuration of the diagonal conjugate, and the estimation from it of the length of the conjugata vera, to appreciate the extent of his services.

Baudelocque,[2] in the latter part of the same century, devoted a great deal of attention to the subject, and it is to him that we are indebted for the first pelvimeter and our knowledge of the importance of the external pelvic measurements.

Stein[25] was the German who played an important part in developing the subject, and in impressing its importance upon his fellow-countrymen.

Since the introduction of pelvimetry and more accurate knowledge concerning pelvic deformity by Deventer, de la Motte, Smellie, Baudelocque, Stein and others, its importance has steadily increased, and the methods of pelvimetry and our knowledge of contracted pelvis have gradually improved.

To mention in detail the progress in this line would be almost equivalent to writing the history of obstetrics for the past one hundred and fifty years, and we shall therefore only refer to the work of Michealis[18] and Litzmann,[11, 13, 12] and then turn from the historical side of the subject. For it is to these two men that we are indebted for perfecting our knowledge upon these lines and making possible the brilliant operative results, of which we are so justly proud.

* Read before the Medical and Chirurgical Faculty of Maryland, May, 1896.

Michealis was professor of obstetrics in Kiel from 1843 to 1850, and during those seven years accurately measured the pelvis in one thousand consecutive cases, and found that 72 of them were contracted to 8.75 cm. (3.5 inches) or less in the conjugata vera. This was the first accurate statistical knowledge on the subject, and his results are as valuable to-day as when his book, "Das enge Becken," first appeared in 1851.

Litzmann[11] succeeded Michealis at Kiel and continued the same line of work and soon collected another thousand cases with accurate pelvic measurements, which with Michealis' cases form the basis of our knowledge concerning the frequency of contracted pelvis.

Up to the time of Michealis, the conception as to what constituted a contracted pelvis varied greatly. Many authors considered a pelvis contracted only when it offered an absolute bony obstacle to labor; while others considered the slightest deviation from the normal standard sufficient to justify the employment of the term. Michealis[16] was the first to suggest a rational terminology, and stated that we should designate as contracted not only those pelves which directly interfere with the birth of the child by direct mechanical obstruction, but any pelvis which is contracted sufficiently to alter the normal mechanism of labor; all pelves having a conjugata vera of 8.75 cm. (3.5 inches) or less being designated as contracted.

And Litzmann[13] stated: "According to my conception, we must consider the border-line, from which contraction of the pelvis from an obstetrical standpoint begins, as such a degree of shortening of one or more diameters, as under ordinary circumstances (medium size and resistance of child) will exert a direct mechanical, but not necessarily retarding influence upon the course of labor."

He placed the border-line at 9.5 cm. (3.8 inches) for flattened and 10 cm. (4 inches) for generally contracted pelves, and accordingly found that 14 per cent. of his cases were contracted. Had the same limits been placed upon Michealis' cases he would have observed 13.1 per cent. of contracted pelves in his series, instead of 7.2 per cent., as he stated.

The limits suggested by Litzmann have been generally adopted, and we usually designate as contracted, flat pelves having a conjugata vera of less than 9.5 cm. (3.8 inches), while in generally contracted pelves the limit is placed at 10 cm. (4 inches).

Since the appearance of the statistics of these two observers, many of the German obstetricians have studied their cases in the same manner; and we shall now adduce some of their statistics to illustrate the frequency of contracted pelvis in Germany and its variations in the various clinics. Thus:

Leopold,[7] in Dresden, 1892–93 (Franke) in 2512 cases, found 24.3 per cent. contracted pelves.

Schwartz,[23] in Göttingen, 1862–65, in 463 cases, found 22 per cent. contracted pelves.

Schwartz, in Marburg, 1859–62, in 501 cases, found 20.3 per cent. contracted pelves.

Weidenmüller,[26] in Marburg, 1885–95, in 3214 cases, found 18.1 per cent. contracted pelves.

Fischl,[8] in Prag, 1882, in —— cases, found 16 per cent. contracted pelves.

Müller,[17] in Berne, 1880, in 1177 cases, found 16 per cent. contracted pelves.

Litzmann,[11] in Kiel, 1850–57, in 1000 cases, found 14.9 per cent. contracted pelves.

Michealis,[16] in Kiel, 1843–50, in 1000 cases, found 13.1 per cent. contracted pelves.

Köttgen,[10] in Bonn, 1895, in 2000 cases, found 13.45 per cent. contracted pelves.

Pfund,[18] in Munich (Winckel), 1885, in 1199 cases, found 9.5 per cent. contracted pelves.

Schatz,[21] in Rostock, 1895, in —— cases, found 9 per cent. contracted pelves.

Gönner,[9] in Basel, 1882, in —— cases, found 7.9 per cent. contracted pelves.

It accordingly appears that from 8 to 24 per cent. of all the women entering the German clinics present more or less pelvic contraction. In other words, every twelfth to every fourth woman has a contracted pelvis.

It is possible that Leopold's[7] figures may be somewhat too high, as they are based in great part upon external measurements alone, and accordingly are not of as great value, as if based upon the results of both external and internal mensuration.

Winckel[25] states that it is safe to say that from 10 to 15 per cent. of the women in Germany present some pelvic contraction, but that only about 5 per cent. are sufficiently contracted to give rise to difficult labors; while Schauta[22] considers that we may assume that every seventh woman will present more or less contraction.

I have been unable to find accurate French statistics to compare with the German, but note that Pinard,[19] in a recent article on symphysiotomy, states that he observed 107 contracted pelves in his clinic during the year 1895, and as he has a material of about 2000 cases a year, this would correspond to a frequency of about 5 per cent. Out of these 107 cases he performed twenty symphysiotomies, which clearly shows that many of them were seriously contracted.

The statistics just adduced give some idea as to the frequency of contracted pelves in Germany and France, and it now remains to consider their frequency in this country.

It is generally believed that contracted pelves are of very rare occurrence in this country, and a casual review of the American text-books would serve to confirm this belief.

Dewees,[4] in his Compendious System of Midwifery, stated that in all his experience he is doubtful if he had met with three cases of contracted pelvis; and this statement concerning their frequency has been very generally accepted and handed down to the present time.

Lusk,[14] in the latest edition of his work, states that all varieties of pelvic deformity may be observed among our foreign-born population, but considers that contracted pelves exist but rarely in our native-born women.

This appears to be the general opinion, and in a discussion before the New York Obstetrical Society, Fruitnight[6] stated that he had observed only 2 contracted pelves in 1000 labor cases.

All the evidence which has been adduced in support of the rarity of pelvic deformity in this country has been of a very

general character, and I am acquainted with only one author, Reynolds,[20] who has attempted to study the question from a statistical standpoint. In 1890 he read a paper before the American Gynæcological Society[20] on this subject, and stated that he had observed only 30 contracted pelves in 2227 labor cases which had come under his control in Boston. This would represent a frequency of 1.34 per cent.

He designated as contracted all pelves having a conjugata vera of 8.75 cm. (3.5 in.) or less, when flattened, or 10 cm. (4 ins.) when generally contracted, and stated that they nearly all occurred in foreign-born women, only three or four of the cases occurring in native-born Americans.

From his own confession, it appears that he only measured the pelvis when some obstacle to labor arose which required operative interference, and it is evident that a large proportion of cases thereby escaped observation, as it is well known that the great majority of women with contracted pelves have spontaneous, if slow, labors.

I agree entirely with Winckel,[21] who says "the publication of Reynolds unfortunately fails to prove anything, because only those cases were measured in which operative interference was necessary. It therefore cannot be claimed that his material was thoroughly worked up," etc. And "so long as it is not demonstrated that rachitis, for example, occurs far more rarely on that side of the ocean than with us, so long as thousands and thousands of pelvic measurements are not adduced, so long will all such statements rest upon a very uncertain foundation."

It is evident that Winckel[21] has struck the keynote, and not until we are in a position to present series of pelvic measurements from thousands of consecutive labor cases shall we be able to prove or disprove the general statements of the text-books.

There is, however, absolutely no doubt to my mind that they occur far more frequently than is generally supposed.

How many of the men here present have not performed craniotomy after fruitless attempts at forceps or version? How many cases of vesico-vaginal fistula have you observed? No doubt, the vast majority of such cases were due to contracted pelvis.

According to the statistics of Zinke,[22] 213 symphysiotomies were performed throughout the world between 1892 and 1894, and of these, 24, or 11 per cent. were done in the United States. All these operations were rendered necessary by pelvic contraction. And does it not appear strange, if they are of so infrequent occurrence as is generally stated, that we should have performed one-ninth of the symphysiotomies of the world; while the European countries, with their large preponderance of contracted pelves, should have to divide the other eight-ninths among themselves?

It is readily understood, in the absence of routine pelvimetry, how a very large proportion of the moderate degrees of pelvic contraction are overlooked, when we consider the relation which the German statistics show to exist between the number of operative and spontaneous labors occurring in these cases. Thus, Michealis[16] showed that 71 per cent. of his cases ended spontaneously, Leopold[7] 69.5 per cent., Gönner[9] 54 per cent., and Pinard[19] 72 per cent. In other words, from one-half to three-fourths of the moderate degrees of pelvic contraction would pass unnoticed, if the pelvis were not measured, unless the obstetrician observed his cases far more accurately than is usually the case.

An article on the frequency of contracted pelvis is hardly the place to point out the effect of the pelvic deformity upon the presentation and position of the child, upon the mechanism of labor or its duration, or upon the prognosis for the mother or child, and we shall, accordingly, pass over this part of the subject, and simply state that a careful examination of the pelvis would reveal in many instances the cause of many abnormal presentations and of many a tedious and difficult spontaneous labor, not to speak of the operative cases.

We now turn from the work of others to our own observations. The routine examination of the pelvis in one hundred consecutive cases has shown us that fifteen of them were abnormal.

In our one hundred cases, we have found one-half as many contracted pelves as did Reynolds[20] in 2227 cases. This is certainly a remarkable showing; and, while I wish it distinctly understood that I consider that we are dealing with too small a number of cases to be justified in basing statistical conclusions upon them, at the same time it serves to prove that Reynolds has overlooked a large number of cases by the omission of routine pelvimetry, and that contracted pelves are far more frequent with us than is generally supposed, and the reason that they are not discovered more frequently is that they are not looked for.

I have designated as contracted only those pelves which presented an oblique conjugata of 11 cm. (4.4 in.) or less, and which correspond to a conjugata vera estimated at 9 cm. or less (3.6 in.)—in other words, only pelves whose conjugata vera is shortened 2 cm. (0.8 in.) or more. In two instances I have departed from this rule and have considered as contracted one pelvis having a conjugata vera of 9.75 cm. (3.9 in.), and another of 9.5 cm. (3.8 in.), for the reason that they both gave rise to difficult labors, necessitating in the one case a difficult breech extraction, and in the other the application of high forceps.

When we analyze our cases according to the variety of deformity presented, we find that we have to deal with:

four rachitic flat pelves,
four simple flat pelves,
five generally contracted pelves,
one coxalgic oblique pelvis,
one transversely contracted pelvis of a male type.

It is usually stated by most American authors that the great majority of contracted pelves, which are observed in hospital practice, occur in foreign-born women, while only a small proportion are observed in the native-born.

When we consider our material from this point of view, we find that seven cases occurred in negresses and eight cases in white women.

Of the eight white women, four were native-born, two were German, one Bohemian and one Irish. These figures certainly do not bear out this statement, as they clearly show that eleven of our fifteen cases occurred in native-born Americans.

It is also of interest to consider how the several varieties of deformity are divided among the various nationalities.

We find that our seven blacks presented three generally contracted pelves, two rachitic and two simple flat pelves.

Of our four native-born whites, two presented simple flat pelves, one a flat rachitic and one a coxalgic oblique pelvis.

One of the two Germans presented a generally contracted pelvis, and the other a transversely contracted pelvis which conformed to the male type.

The Bohemian had a generally contracted, and the Irish woman a flat rachitic pelvis.

No doubt, to most of you, the data just adduced possess only a purely scientific interest, and we shall therefore turn to the more practical consideration of the effect of the contracted pelvis upon the course of labor.

Two of the pelves considered in this paper belong to women who have not yet been confined, but it may be of interest to consider the history of their past labors. The first case is a colored secundigravida, with a generally contracted pelvis, whose previous labor was very slow and was terminated by the forceps delivery of a dead child. And the other case is a German who has had two children. She has a transversely contracted pelvis of the male type, very deep, with a very high symphysis pubis, lateral contraction of the pelvic outlet, the distance between the ischial tuberosities being about 8 cm., and the conjugata vera 8.5 cm. (3.4 in.), both her previous labors having been terminated by craniotomy.

It is apparent that the pelvic contraction in these two cases is quite marked, and played an important part in the production of the fœtal mortality in the previous labors.

Of the thirteen cases which have already been delivered, seven were delivered spontaneously, while six necessitated operative interference.

Five of the seven spontaneous cases were delivered at full term of live children. The sixth spontaneous case was a syphilitic colored primipara, with a flat rachitic pelvis, conjugata vera 8 cm. (3.2 in.), who was delivered at the eighth month of a macerated syphilitic fœtus; while the seventh case resulted in an abortion at the sixth month. This was an Irish woman, pregnant for the third time. Both her previous labors had resulted in dead children after tedious forceps operations, the last delivery resulting in a complete perineal tear and a large vesico-vaginal fistula, which were repaired at the Johns Hopkins Hospital. This case was spontaneous only because of the abortion, and the probabilities are, had she gone on to full term, that she would have required a symphysiotomy.

The six cases which required operative interference were delivered as follows:

four by high forceps,
one by craniotomy on dead child, and
one by a difficult breech extraction.

No one can hear these somewhat dry statistical statements without being convinced of the very important part played by the pelvic deformity in the cases before us.

It is evident that the deformity alone, or the abnormalities in the mechanism of labor produced by it, were the direct cause of the various operative procedures which we have just mentioned, or of the fœtal mortality in the previous labors of the women who have not yet been confined.

Who, after hearing these results, can say that the study of moderate degrees of pelvic contraction is not worthy of far more consideration and investigation than are accorded them by most of us?

I believe that I have made it evident that pelvic contraction is of far more frequent occurrence than is generally believed, and that it is the cause, directly or indirectly, of a large proportion of the obstetrical operations which we are called upon to perform.

Does it not then behoove us to be on the lookout for it, and prepared to recognize it before the onset of labor, so that we may be prepared in advance for the eventual forceps or version, and in rare cases for the more serious operations of symphysiotomy and Cæsarian section?

This necessitates the careful and routine examination of every pregnant woman before the onset of labor, when we should map out the presentation and position of the fœtus and carefully study the form and size of the pelvis.

It is not until this is done that we are doing anything like our full duty by our patients, and if I have succeeded in impressing the importance of the systematic examination of pregnant women, including pelvimetry, upon a single man here, I shall feel amply repaid for the preparation of this paper.

Dohrn[5] stated some years ago, "that the physician who does not measure the pelvis is comparable to one who diagnoses heart and lung troubles without the aid of auscultation and percussion"; and I can only indorse his statement. At the same time I do not wish to be understood as advocating pelvimetry as the *summum bonum* of obstetrics. I have just shown you its importance, but unfortunately its practical teachings are not absolute.

The birth of the child is dependent not only on the size of the pelvis, which we can determine with reasonable accuracy, but also upon the size of the child's head, its compressibility and adaptability, and the character of the labor pains, which unfortunately we can only approximate, but never determine absolutely in the concrete case.

Therefore, in moderate degrees of pelvic contraction, pelvimetry does not give all the information we desire. And with pelves of the same size, we sometimes find that one patient is delivered spontaneously, while with the next we are obliged to resort to operative interference.

These considerations, however, do not absolve us from the necessity of pelvic mensuration; they only teach us its limitations and enable us to comprehend the more fully the many factors which should be considered by the conscientious accoucheur.

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HOSPITAL PLANS.

Five essays relating to the construction, organization and management of Hospitals, contributed by their authors for the use of The Johns Hopkins Hospital.

These essays were written by DRS. JOHN S. BILLINGS, of the U. S. Army, NORTON FOLSOM of Boston, JOSEPH JONES of New Orleans, CASPAR MORRIS of Philadelphia, and STEPHEN SMITH of New York. They were originally published in 1875. One volume, bound in cloth, price $5.00.

SPECIAL COURSES FOR GRADUATES IN MEDICINE GIVEN BY THE JOHNS HOPKINS UNIVERSITY AND HOSPITAL.

CHANGE OF DATE.

With the completion of the organization of the Johns Hopkins Medical School, it has been found necessary to give the *courses intended especially for physicians* hereafter during the months of May and June, instead of at an earlier period of the academic year as heretofore. This new arrangement applies to the academic year beginning October, 1896. The courses of instruction for the undergraduates who are candidates for the degree of Doctor of Medicine are open only to these undergraduates. Physicians, not candidates for a degree, are admitted only to the special courses which begin May 1, 1897, and which continue for two months. Those who have had the requisite training and desire to undertake advanced and research work in the various laboratories, may be admitted at any time during the academic year, at the discretion of those in charge of these laboratories.

It is believed that the new arrangement as to the time of holding the graduate courses will prove to be more convenient than the former one to the majority of those desiring to take the courses.

These courses are intended especially to meet the requirements of practitioners of medicine. They include laboratory courses in pathology, bacteriology and clinical microscopy, and practical instruction in the hospital and in the dispensary in medicine, surgery, gynecology and the various special departments of practical medicine and surgery.

The detailed statements concerning these courses, the fees and all other necessary information, will be found in the published Announcement of the Special Courses for Graduates in Medicine, which will be sent upon application to the Johns Hopkins Medical School, Baltimore.

NOTES ON NEW BOOKS.

Text-Book of General Pathology and Pathological Anatomy. By RICHARD THOMA, Professor of General Pathology and Pathological Anatomy in the University of Dorpat. Translated by ALEXANDER BRUCE, M. A., M. D., F. R. C. P. E., F. R. C. S. E.; Lecturer on Pathology, Surgeons' Hall, Edinburgh, etc. Volume I, with 436 Illustrations. (*London: Adam and Charles Black*, 1896.)

This translation of Thoma's Lehrbuch der allgemeinen pathologischen Anatomie, which appeared in the original in 1894, is a welcome addition to the rather meagre list of pathological text-books in the English language. This first volume treats of general pathological anatomy and general pathology, the part relating to special pathological anatomy not having yet appeared in German.

Section I of the book is devoted to general etiology and is taken up mainly with the description of pathogenic micro-organisms and entozoa. Upon the whole this section is less satisfactory than the remaining parts of the book, as indeed is now-a-days usually the case in text-books on General Pathology. The student cannot dispense with works devoted especially to the description of pathogenic micro-organisms and other parasites.

The heading of Section II is "Elementary Forms of Disease." This section is occupied with the consideration of "Disturbances of the Circulation of the Blood" and the "Disturbances of Tissue Nutrition." The treatment of the subject of the circulatory disturbances constitutes the most original and valuable part of the work. It is especially in this field of pathology that Thoma has labored for many years with brilliant success, during the period both of his assistantship to Prof. Arnold in Heidelberg and of his professorship in Dorpat. His presentation of the subject of the general and local disturbances of the circulation is an admirably

clear and important contribution, and can be confidently recommended to students of pathology as worthy of careful reading. It is based throughout upon a large amount of original investigation, characterized, as is so much of Thoma's original work, by ingenious experimentation and by the effort to attain mathematical accuracy and to find mechanical explanations of pathological phenomena. Thoma's highly important researches on angio-sclerosis are considered in this section only in part. It is much to be desired that the volume to be devoted to special pathological anatomy may appear before long, for this will contain doubtless a compendious and authoritative presentation of his studies on angio-sclerosis, now widely scattered and difficult for the ordinary reader to grasp in their entirety.

The third and final section of the book is entitled "Combined Forms of Disease," and is devoted mainly to tumors. The concluding chapter on General Diseases contains a condensed and inadequate consideration of the general pathology of fever. In the first chapter of this final section Thoma presents his well-known views advocating the abandonment of the term "inflammation." All of circulatory and exudative phenomena of inflammation are treated in this work, not under the general heading of inflammation, but under the "Local Circulatory Disturbances," being resolved into their components, such as Hyperæmia, Stasis, Diapedesis, Emigration, Exudation. So far as inflammation is to be considered as a circulatory disturbance characterized by exudation, it is entirely practicable to treat it in the manner adopted by Thoma, although not without loss of comprehensiveness and of perspective. But inflammation cannot be resolved wholly into a circulatory disturbance with exudation, and it is interesting to consider how the author of a text-book on pathology who proposes to discard the word "inflammation" would attempt to deal with the entire group of phenomena, including regressive and progressive changes of tissue, which are usually embraced under the conception of inflammation. Thoma himself, after setting forth his various objections to the perpetuation of the word inflammation, evidently finds it impracticable to get along without it. Besides the simple circulatory disturbances and the simple nutritive disturbances and tumors, there remain what Thoma describes as "combined pathological conditions of the organs which have been almost without exception described as inflammations." These conditions must be described as a whole, and some name is needed to designate the group of elementary pathological changes which are comprised in "these combined pathological conditions." We have no name, and Thoma suggests none other than inflammation for these "combined pathological conditions," nor is a better one likely to be found and to gain currency.

The work of the translator is in general good. Occasionally, however, the sense of the original has been lost, as on page 351 where the translation reads "deficiency of albumen and the pronounced watery condition of the blood cannot be regarded as the cause of the œdema, if this change also diminishes the amount of albumen in the fluid of œdemas which are due to other causes." This apparently incomprehensible statement becomes clear when it is found that the author said, "although this change diminishes the amount of albumen," etc. And in the sentence following the preceding one, the sense of the original is not accurately preserved in the translation which reads, "The so-called hydræmic œdema appears as the result of disease of the capillary walls which increases their permeability, and is itself associated with angio-sclerosis." The last part of the sentence is in the original, "in Beziehung steht zu der Angiosklerose." These failures to present the exact sense of the original happen to occur in particularly important and italicized sentences giving Thoma's conclusions as to the cause of so-called hydræmic œdema.

The publishers' work deserves only commendation. The clear typography, the reproductions of the usually excellent figures and the general appearance of the book are admirable. W. H. W.

Atlas of Nerve Cells. By M. ALLEN STARR, M. D., Ph. D., with the co-operation of OLIVER S STRONG, A. M., Ph D., and EDWARD LEAMING, M. D., F. R. P. S. Pp. 1–78, with fifty-three plates and thirteen diagrams. (*New York and London: Published for the Columbia Univ. Press, by Macmillan & Co.*, 1896.)

The atlas consists of a series of artotype reproductions of photographs made by Dr. Leaming from tissues stained (in the main by Golgi's method) and sectioned by Dr. Strong, together with a descriptive text by Dr Allen Starr, in which many of the essential facts which are at present known concerning the distribution and interrelations of the neurons within the central nervous systems have been included.

In the introductory note upon the Golgi method, Dr. Strong describes in some detail the various modifications which he has employed, referring especially to (1) a "lithium bichromate method" by means of which he gets quickly results equal to those obtainable by the long method, and (2), a formaline-bichromate method which is even more certain, and which he has found of especial value in the study of the adult brain.

The photographic technique is discussed in a section by Dr. Leaming, in which there will be found some notes of interest to those engaged in photomicrography regarding (1) a modification of the tropæolin screen, and (2) a method of obviating diffraction spectra and halation.

Dr. Starr states in the beginning that he has "not attempted to write an exhaustive account of nerve histology, but rather to present a brief review of the essential facts which can be demonstrated by the aid of the Golgi stain, and to show how these facts aid in the knowledge of nervous action."

As regards the structure of the spinal cord, cerebellum, and cerebral cortex, the researches of Golgi, Cajal, van Gehuchten, His, Retzius, v. Kölliker, v. Lenhossek, Berkeley and others have been freely used, and a clear epitome is given. The medulla and pons have not been extensively treated. It is pleasing to note that the relations of the superior colliculi of the corpora quadrigemina to the optic nerves, and of the inferior colliculi to the cochlear nerves, have been emphasized. We should have been glad to find the central relations of the cochlear and vestibular nerves dealt with rather more in detail, now that this has been rendered possible through the brilliant researches of Held of Leipzig.

Concerning the nuclei in the thalamus and their connections, the results of von Monakow's work (published at length in the Archiv f. Psychiatrie) have been briefly abstracted and incorporated. Dr. Starr further describes in connection with the thalamus (p. 53) certain cells which are especially characteristic of the median and lateral nuclei, to which he gives the name "stellate cells of the thalamus." He speaks too of some cells hitherto undescribed, which he believes to be peculiar to the ventral nucleus of the thalamus (*vide* Pl. xxviii). The text includes also notes on some original studies of the nucleus caudatus and nucleus lentiformis.

In view of the recent work of Flechsig (cf. Neurol. Centralbl., 1896, No. 1), Fig. 12, p. 73, is perhaps open to objection, but all must feel grateful to find reproduced in the atlas the beautiful plates of the cortex taken from the "Studien" of the late celebrated Swedish investigator, Hammarberg. His studies of the cellular structure of the cerebral cortex are by far the most exact which up to the present time have been undertaken, although they are not so widely known and appreciated as they deserve to be.

The press-work has been excellently done, and the reproductions of the photographs are superb. The plates are remarkably even in character; that showing the spinal ganglion in the chick and those illustrating Purkinje cells are particularly beautiful.

It is the intention of the author at some future time to issue another volume, in which there will be illustrated the peripheral nerves and their endings, together with the organs of sense.

L. F. B.

Text-Book upon the Pathogenic Bacteria. By JOSEPH MCFARLAND, M. D. (*W. B. Saunders, Philadelphia*, 1896.)

Dr. McFarland's book opens with an introductory chapter which discusses principally the controversies which were waged upon the subject of spontaneous generation, and ends with a list of the principal pathogenic organisms discovered from 1879 to the present time.

Chapters one and two deal with the morphology and biology of bacteria, the classification of Cohn is cited as the most scientific one, and the various points bearing on the growth and development of bacteria are fully discussed. In chapter one it is twice stated that the bacillus coli communis is a non-motile organism, a statement we think which is hardly borne out by the work of recent investigators, particularly that of Theobald Smith. In chapter two the statement that most species of bacteria are not affected in their growth by the presence or absence of light is contrary to the teachings of most bacteriologists.

Chapter three deals with immunity and susceptibility; it covers this difficult ground as well as could be expected in such a short space.

Chapters four to nine deal with technique, the proceedings recommended being similar to those ordinarily in use in all laboratories.

The examination of water, soil, and air is taken up in a brief manner in the three following chapters.

The second part of the book deals with specific diseases and their bacterial causes. It opens with a chapter on suppuration, in which the ordinary pus-producing organisms are described. We cannot agree with the statement that the staphylococcus pyogenes aureus shows its most characteristic growth upon agar, as oftentimes the color is almost entirely lacking on this medium, whilst on the other hand the growth on potato rarely fails to show pigment from the very outset. The statement that the streptococcus does not grow on potato is evidently meant to imply that it has no visible growth. The statement that the bacillus pyocyaneus is probably "a harmless saprophyte" does not accord with the work of Gessard, Chasrin and others who have implicated this organism in a definite form of intestinal infection, the so-called "maladie pyocyanique."

The chapters on tuberculosis, leprosy and the other chronic infectious diseases are short and concise.

The chapter on diphtheria is a fairly satisfactory review of the subject, though most bacteriologists probably regard the pseudo-diphtheria bacillus as a separate organism, and not as an attenuated diphtheria bacillus, as the author states it to be.

Tetanus, rabies and symptomatic anthrax are treated of briefly and satisfactorily; it is to be noticed in the chapter on the last-named subject that the proteus vulgaris is spoken of as a harmless saprophyte, an opinion quite commonly held, but which is disproved by the association of this organism with Weil's disease, pleurisy, peritonitis, etc.

Typhoid fever is satisfactorily treated of, though the statement that the typhoid bacillus slightly acidifies litmus milk is too sweeping, as the acidification is in many instances followed by a marked alkalinization.

The cholera group is taken up satisfactorily in chapters six and seven.

In the chapter on pneumonia the statement is twice made that the diplococcus pneumoniæ will not grow on potato, when, as a matter of fact, it does grow on this medium, though the growth is often invisible. The statement that the diplococcus pneumoniæ, which is normally present in the mouth in a certain percentage of cases, can be drawn into the bronchioles by a deep inspiration is a rather startling one. In the first place, currents of air do not detach bacteria from moist surfaces, and in the second, the inspired air does not reach the terminal bronchioles.

The remainder of the book takes up bubonic plague, measles, influenza, and a number of the infectious diseases of animals.

Barring the minor mistakes mentioned above, the book is fairly satisfactory; there are occasional typographical errors, and in places the author's language is a little obscure.

The plates are good.

G. B.

Ueber die Wirkung der Theebestandtheile auf körperliche und geistige Arbeit. By AUGUST HOCH und EMIL KRAEPELIN. Kraepelin's Pyscholog. Arbeiten, Band I, Heft 2 and 3, pages 378–488.

The results of this research are among the most interesting of recent psycho-pharmacological contributions. The investigators have undertaken an exact study of the action of the two main constituents of tea, the caffein and the ethereal oils, paying particular attention to the effects of these substances, (1) on muscular work, and (2) on the association processes concerned in adding. To determine the former, the ergograph was used, and no small part of the problem consisted in so modifying this instrument as to make it accurate enough for the research. A large number of curves showing muscle-fatigue with and without the action of the substances under examination, were obtained from the individuals submitting themselves to experiment, every precaution being taken to eliminate error from irregularities in work, rest, sleep, the taking of food, etc. The experiments were made upon Drs. Hoch, Jost, Hibbard and Reis; the majority of them in Kraepelin's laboratory in Heidelberg, a part of them in the laboratory of the McLean Hospital in Massachusetts.

The experiments made upon Dr. Hoch showed that caffein distinctly increased the capacity for muscular work, the ergograph curve proving that this increase affected mainly the amplitude of the individual movements rather than the number of them. The tea-oil, on the contrary, lessened the capacity for muscular work, but made distinctly easier the associative processes concerned in adding. The results of the experiments on Drs. Hibbard and Reis agreed in the main with those obtained with Dr. Hoch; the experiments made upon Dr. Jost differed considerably, in that larger doses of caffein were required, and besides the effects appeared later and lasted very much longer, a personal difference perhaps not so very surprising considering what is already known of the action of alcohol upon different individuals.

The mode of action of the caffein and of the oils is discussed at some length and most entertainingly. The details must be sought in the original article, but it may be interesting to state that the authors conclude that the caffein acts immediately upon the muscular tissue, permitting the increase in the amplitude of the individual movements without materially altering their number; while the tea-oil acts upon the motor centers in the nervous system, rendering difficult the setting free of motor impulses, and so affecting the number rather than the amplitude of the movements. While the caffein in tea is known to render the course of ordinary associations somewhat easier, the experiments of Hoch and Kraepelin have led them to conclude that the associative processes are also distinctly facilitated through the action of the ethereal oils, and they state that the euphoria of the tea-drinker may depend in large part upon the action of these ethereal oils upon his nerve centers.

The presence in the same crude drug of two chemical substances possessing almost diametrically opposite effects is by no means unique: a number of similar instances in pharmacology will be immediately recalled.

It is easy to see that the results of the research, aside from their high scientific value, have also an eminently practical bearing; since the quality and psychic effect of a given sample of tea will depend largely upon the relative proportions of the caffein and the ethereal oils which it contains, the qualitative determination of these may afford a new field of activity to the commercial chemist.

L F. B.

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